ECHNOLOGY DEPT.

Gas Journal

VOL. 275. 105TH YEAR. LONDON, AUGUST 19, 1953. NO. 4707. PRICE 1/3

DETROIT

Illustration by kind permission of R. J. Barritt, Esq., Div. Carbonisation Manager.

A bird's-eye view of 14,000,000 cubic feet per day

★

THAT is the capacity of these four "DONKIN" Gas Compressors, installed at Nantgarw Coke Ovens of the N.C.B., South Western Division, with foundations for another machine to pass a further 6,000.000 cubic feet per day.

★

RELIABILITY, STURDINESS AND FIRST-CLASS WORKMANSHIP are the keynotes of these machines, which are required to withstand long periods of continuous operation. When requiring a Gas Compressor be sure to get more than a bird's-eye view of a "DONKIN" unit. Let our engineers show you the picture from all angles.

The

COMPANY LIMITED

LONDON · MANCHESTER

— Members of the Society of British Gas Industries —

Progressive plant for the Gas Industry

The hallmark of high quality plant

GASHOLDERS

by

A modern 4 lift spirally-guided gasholder by R. & J. D. Ltd.
(from a photograph by courtesy of the N. Thames Gas Board)

We manufacture and erect frame-guided, high-pressure, spirally-guided, and waterless (M.A.N.) gasholders.

We also make by-product plant, condensers, detarrers, gas valves, iron castings, purifiers, stills, tanks, washers, water-gas plant and riveted and welded steelwork.

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DEMPSTER
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GAS PLANT WORKS · NEWTON HEATH

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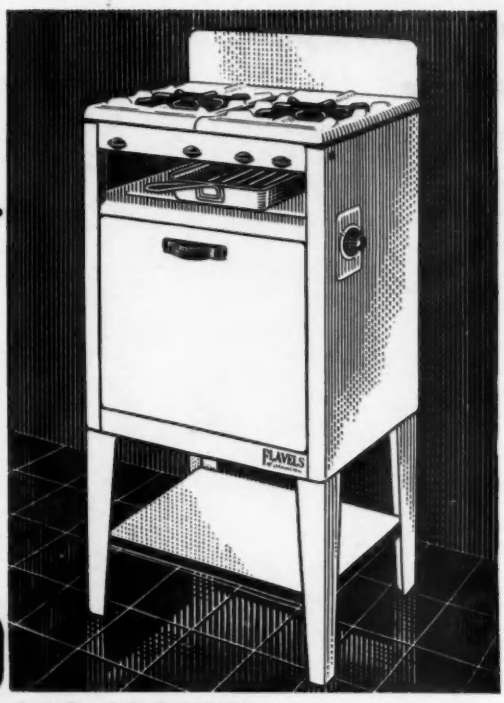
▲

The little Cooker

with the big performance..



The Perfect Cooker for the "one roomer" or the small flat where space is at a premium. Compact, efficient and attractively finished in gleaming **CREAM** porcelain enamel.

Modestly priced and capable of cooking for one to four people.

The **IMP** **GAS COOKER**

★ **Supplied with or without oven heat control**

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FLAVELS of LEAMINGTON *Makers of fine quality cooking and heating appliances since 1777*

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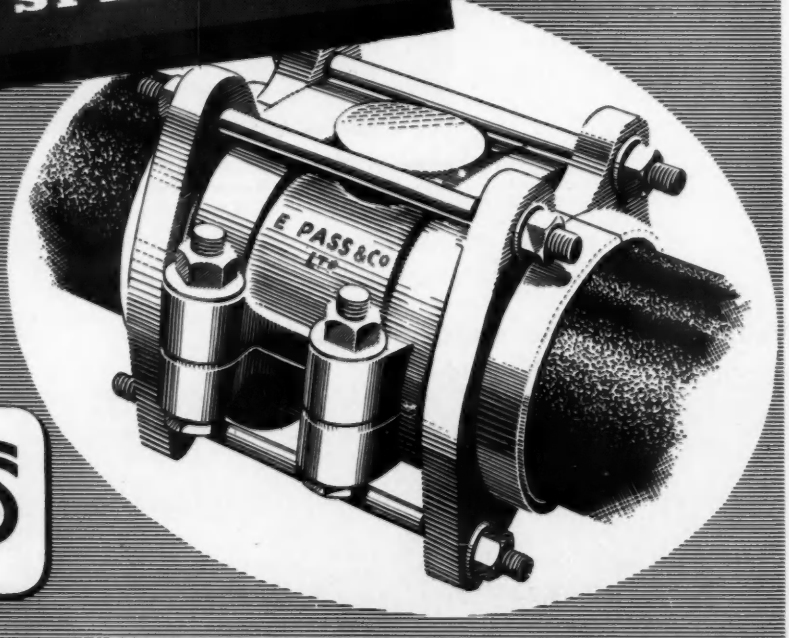

PASS

GAS AND WATER ENGINEERS

E PASS & CO LTD DENTON MANCHESTER

dm PA. 5

The new coke handling plant by CORTS at GILLINGHAM KENT

A completely modern installation incorporating an extensive dust extraction plant, with stocking and reclaiming facilities.

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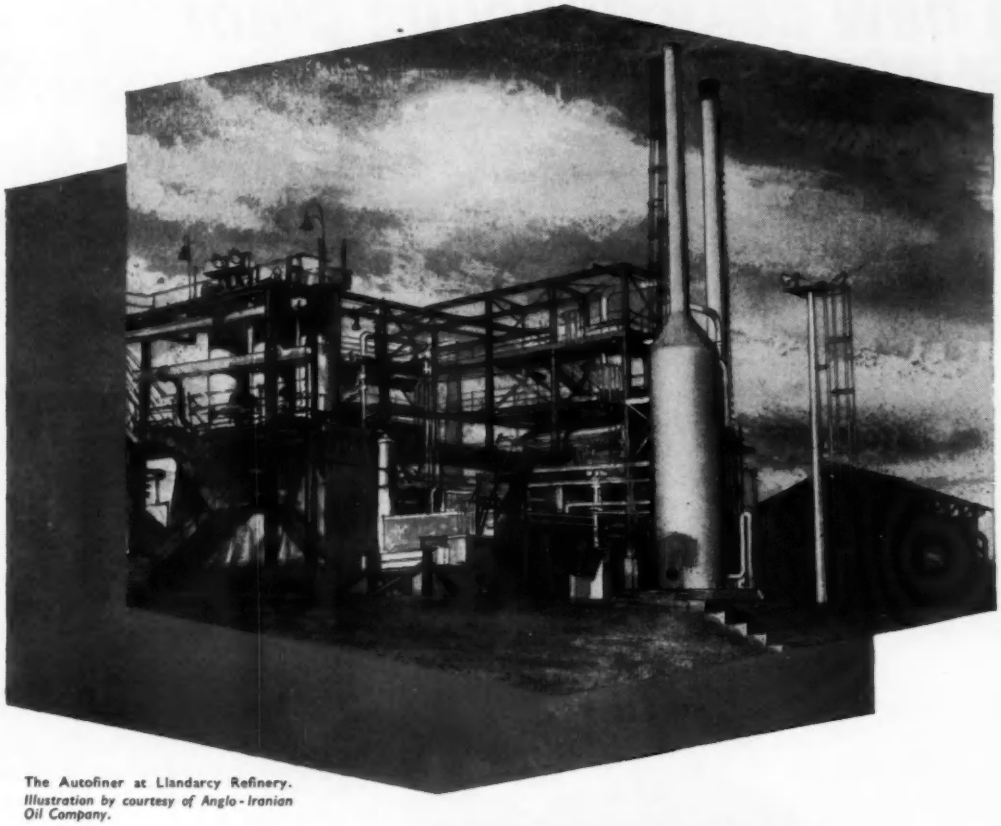

The Autofiner at Llandarcy Refinery.
Illustration by courtesy of Anglo-Iranian Oil Company.

An outstanding development . . .

The Anglo-Iranian Oil Company's Autofining process is an outstanding development in the field of petroleum refining technology. The catalyst used in this process is produced by Peter Spence & Sons Limited.

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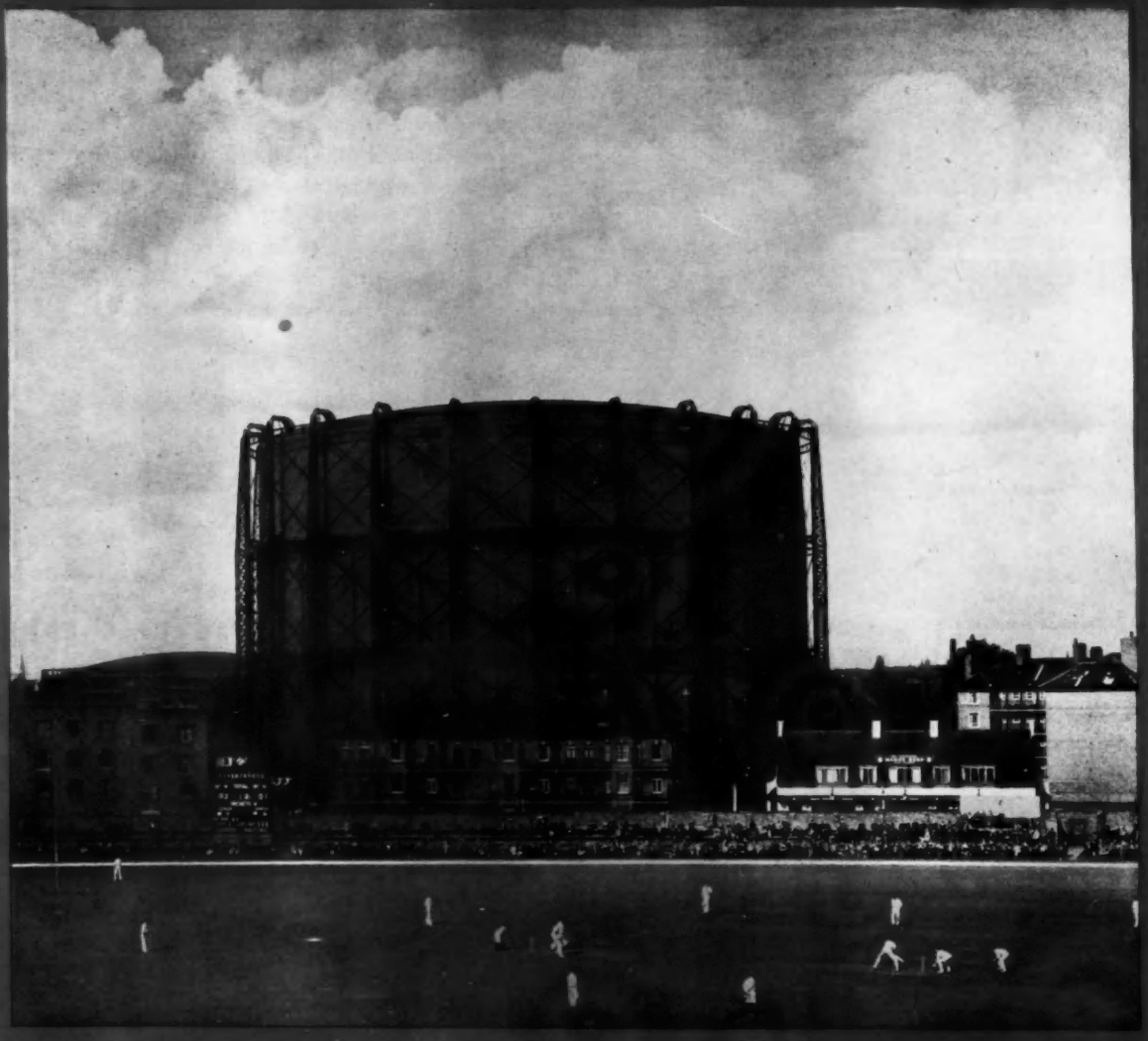

CRAFTSMANSHIP AT ITS BEST
ON AND OFF THE FIELD

The 6 Million Frame Guided Gasholder at Kennington Oval, was reconstructed following war damage, by Claytons of Leeds ; in the background . . . the new 2 million Spiral Guided Holder, also erected by Claytons to replace another war-damaged Holder.

Gasholders of all Types by

CLAYTON SON & CO. LTD.
HUNSLET LEEDS YORKSHIRE

REMOVES DUST FROM ANYWHERE

B.V.C. DUAL-PURPOSE
VACUUM CLEANER

Model T.87 has been specially designed to be of maximum service in gas works. It is a highly efficient, large capacity, mobile unit with a water cooled container for receiving hot dust and smouldering ashes. Can be used by up to four operators for surface cleaning.

Designed specially for GAS WORKS

REMOVES HOT SOOT AND ASH

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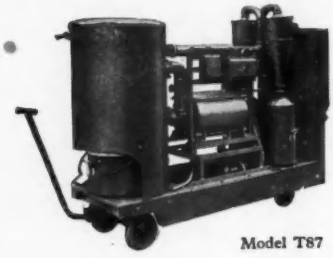
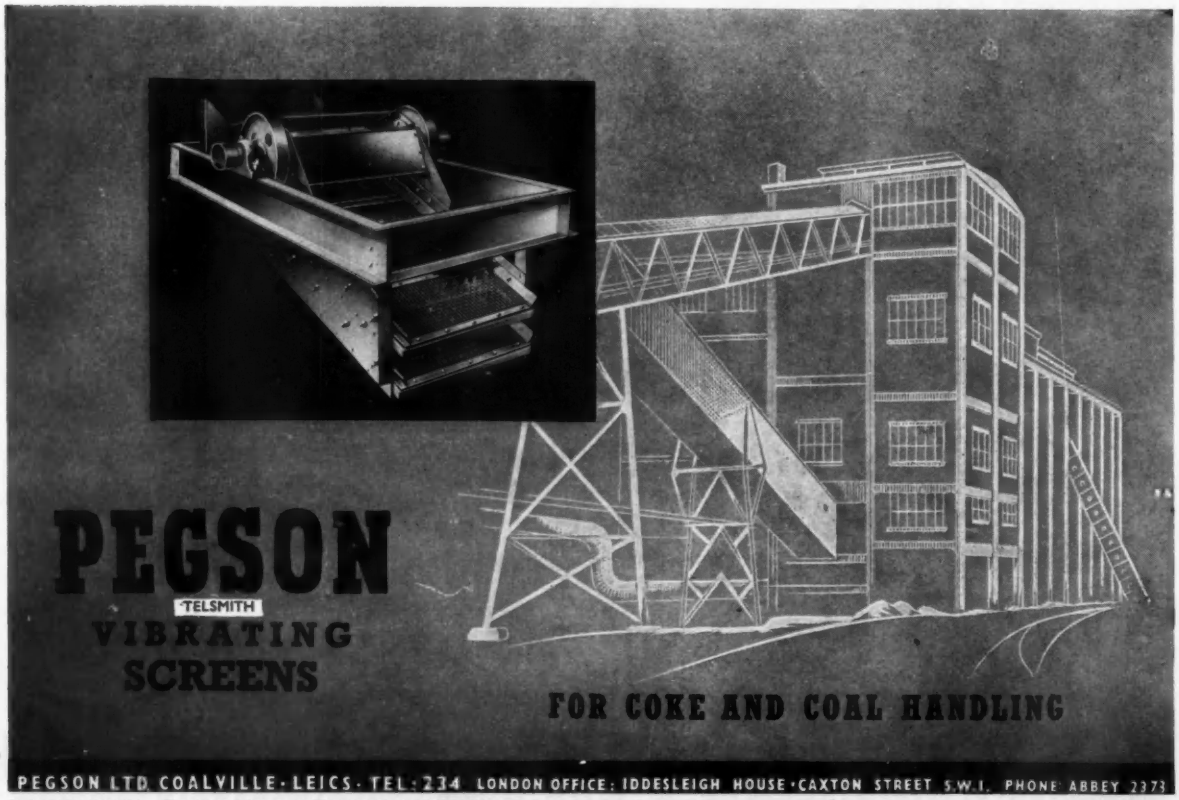


Model T87

B.V.C
"BRITISH VACUUM CLEANER"

INDUSTRIAL VACUUM CLEANERS

The British Vacuum Cleaner & Engineering Co., Ltd.
Dept. 63 R, Goblin Works, Leatherhead, Surrey



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& DRY VACUUM PUMPS
FOR AIR OR GAS.

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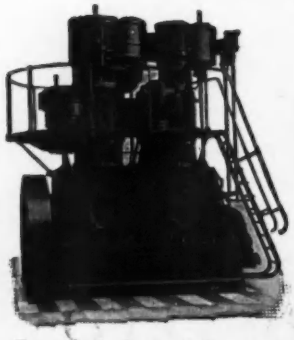

These double-acting cross-head type Compressors are provided with forced lubrication. They may be driven by any suitable power unit, as shown below, or by steam cylinders in tandem with the compressor cylinders making a self-contained unit, as shown on the left.

Single Stage. Pressures up to 40 lbs. per sq. in.
Capacities up to 10,000 cu. ft. per min.

Two Stage. Pressures up to 120 lbs. per sq. in.
Capacities up to 5,000 cu. ft. per min.

For particulars of these machines and for other types write (mentioning this journal) to:—

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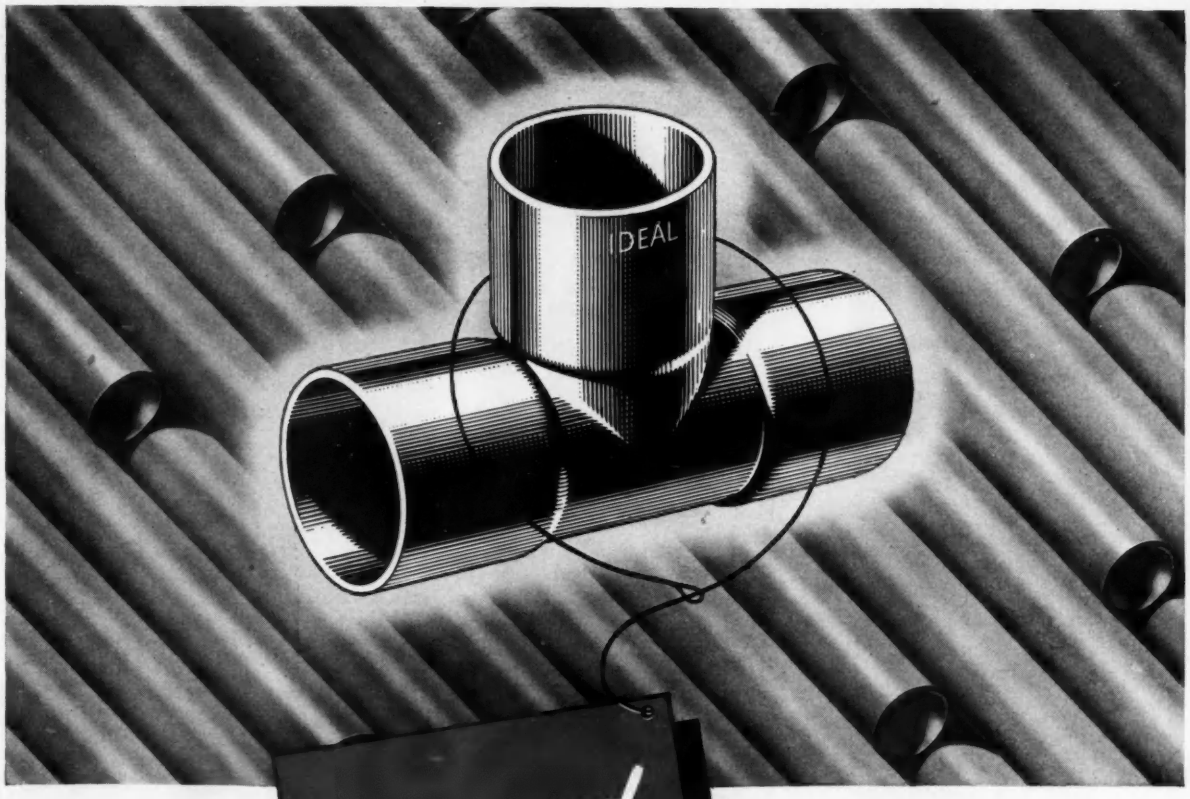

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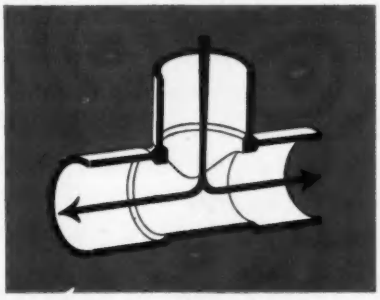
FOR USE WITH COPPER TUBE. Ideal Improved Full-way Fittings are TINNED THROUGHOUT and ready for immediate use. No cleaning is necessary, therefore no time is wasted by having to scour with steel wool on the inside to prepare them for soldering. This reduces the possibility of imperfect joints caused through faulty cleaning and overcomes frayed tempers or fingers brought about when working with small-bore tubes and fittings. Besides the reduction in installation costs there is less possibility of corrosion or electrolytic action. They provide free, unrestricted flow as the tube seats against the shoulder of the sockets in the fitting and the bore is therefore flush throughout. They are unaffected by hot water or by temperatures below freezing point and the joints are actually stronger than the tube itself. Most suitable for use in confined spaces they are uniform and interchangeable and manufactured for use with light gauge copper tube to Nos. B.S.S. 659 and B.S.S. 1386.



A new illustrated booklet giving full details and prices of the complete range of fittings and accessories is available from our Builders' and Plumbers' Merchants' Stockists in all districts.

If there is any difficulty in obtaining a copy, please write direct to the address below.

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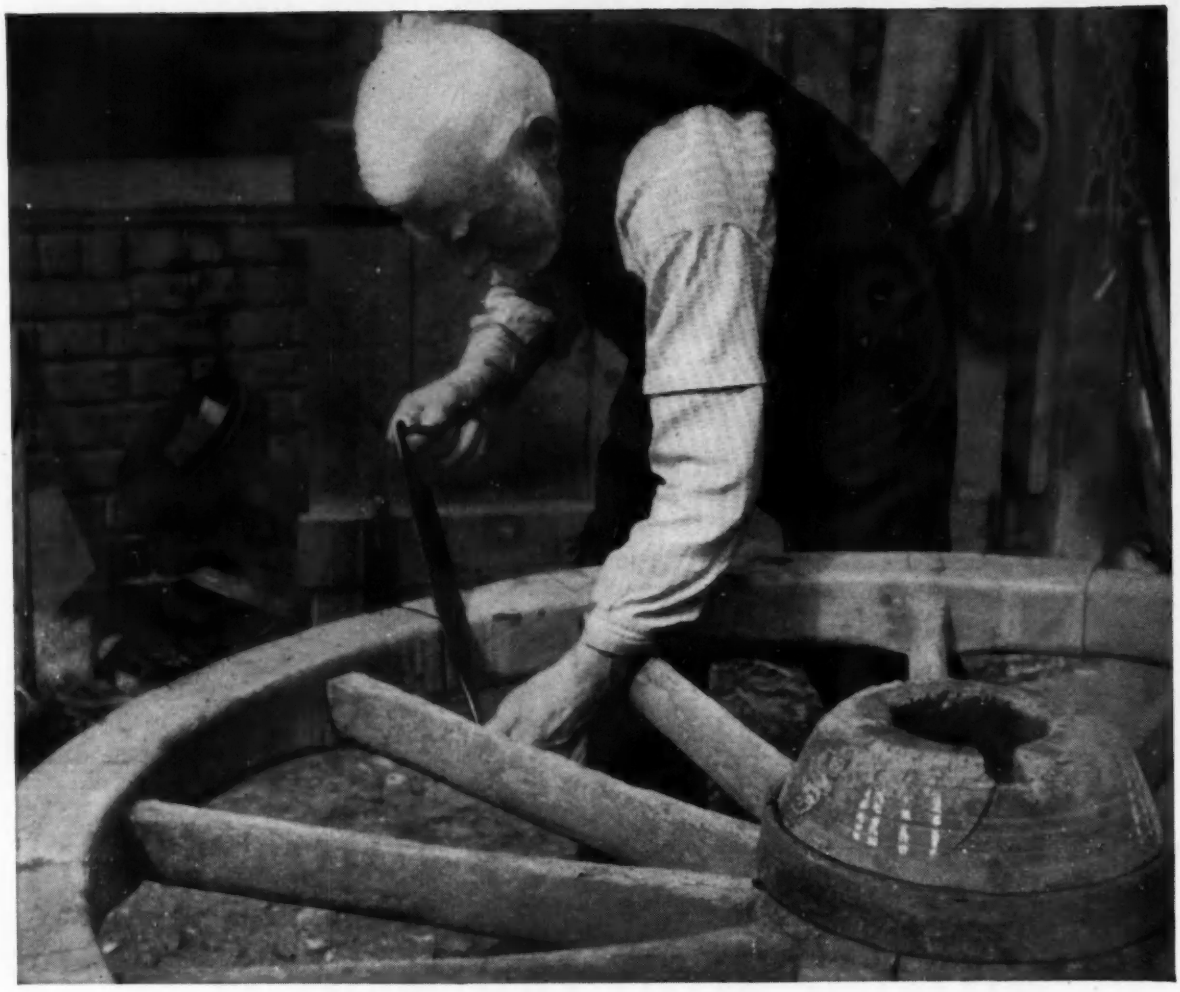

The full round

A worn wheel, an aged craftsman, a dying craft —killed by the march of progress—yet such is the spirit of craftsmanship that this wheel will be repaired with the same care and skill as if it had been the very latest creation for M'Lord's post-chaise.

Craftsmanship is not only skill, but a pride in one's skill, which will not allow shoddy work or anything that is not of the very best possible design, materials and workmanship. We have always set an exacting standard. Our craftsmen are second to none, as are the methods and materials we use. That is why 'Multitest' Gas Meter Diaphragms have a world-wide reputation for unsurpassed quality.

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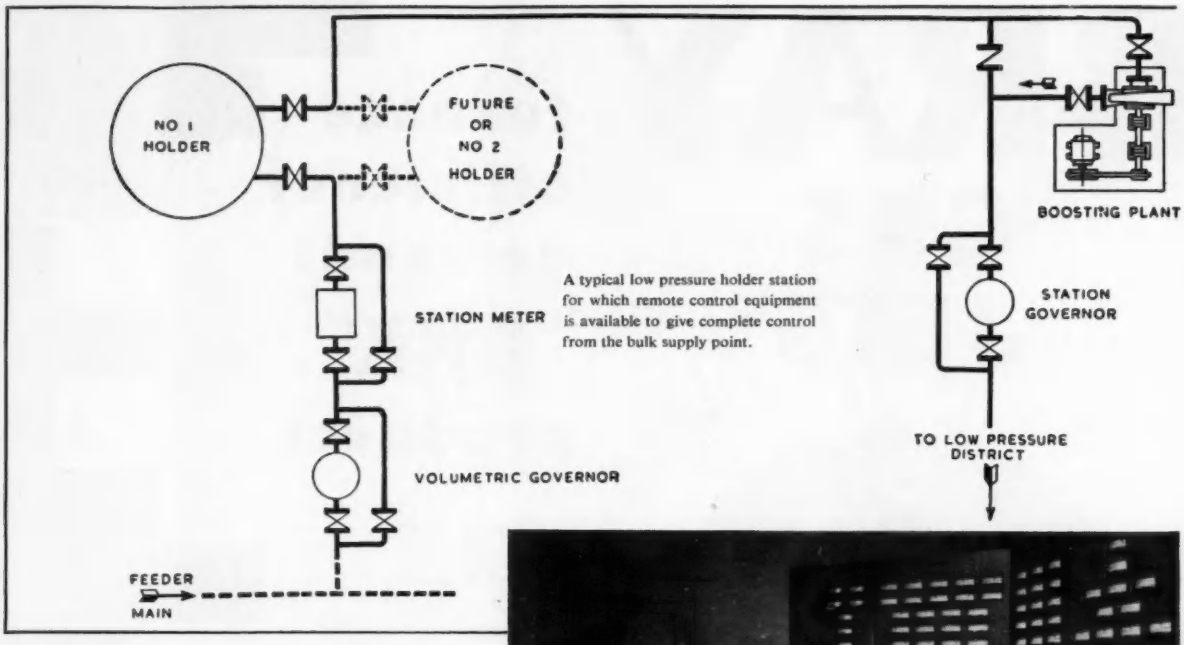
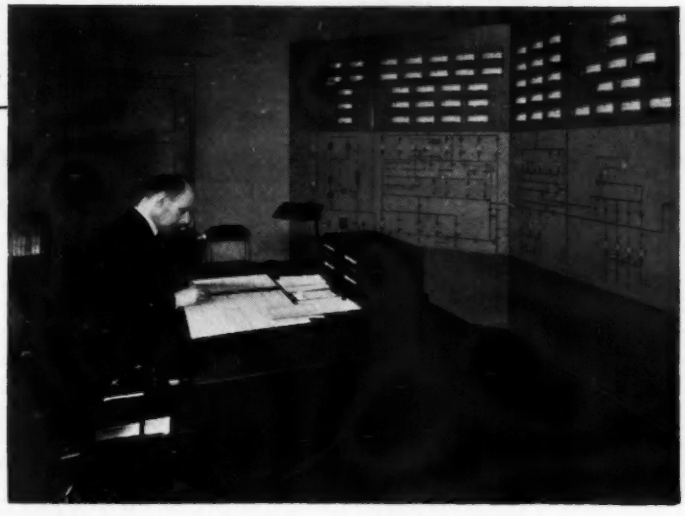


A typical low pressure holder station for which remote control equipment is available to give complete control from the bulk supply point.



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Equipment is now available which enables the engineer in charge at a central point of a complete distributive network to exercise remote control. The control system is so designed as to ensure that *every* station is supplied with an adequate amount of gas at times when a particular load has to be met. Plant and mains are operated as near 100 per cent load factor as possible. Peak demands on feeder mains can be minimised and the plant operated at fullest efficiency throughout every 24 hours. The suite of panels shown above provides remote control indications and meter readings for a large undertaking. With certain exceptions, attendants are not required at the remote stations. It will be evident that the control engineer has before him a schematic diagram of the distribution system giving complete "up-to-the-minute" information. Please write for further details.

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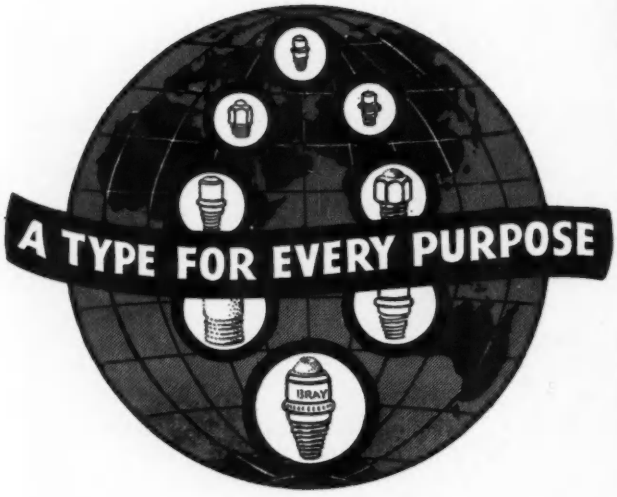

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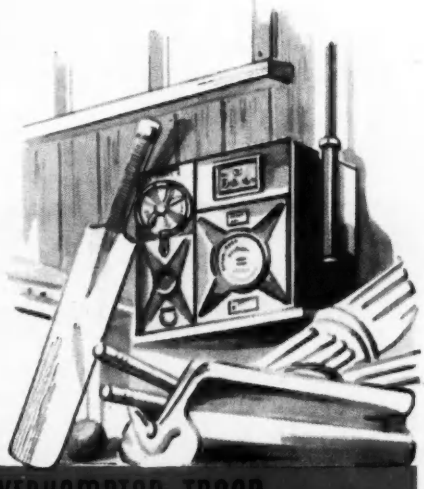

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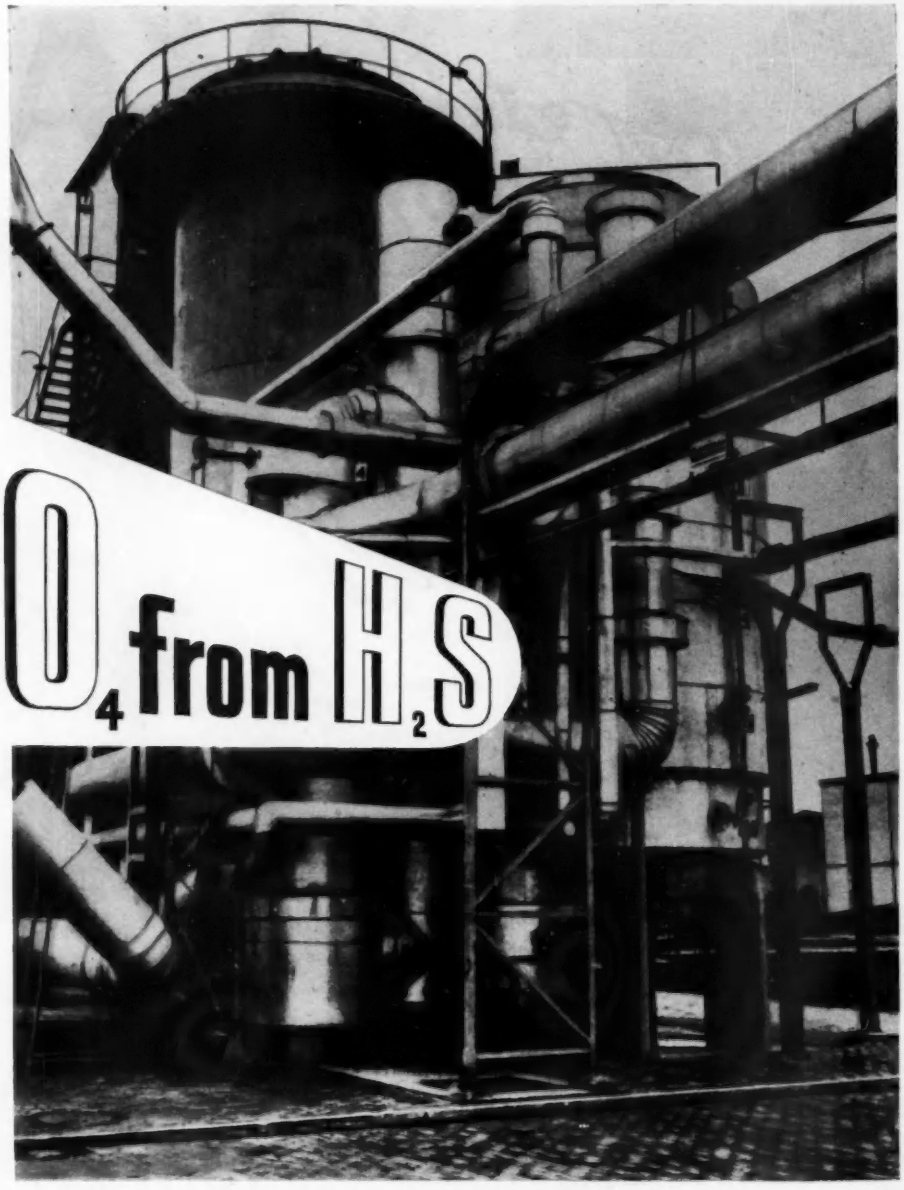

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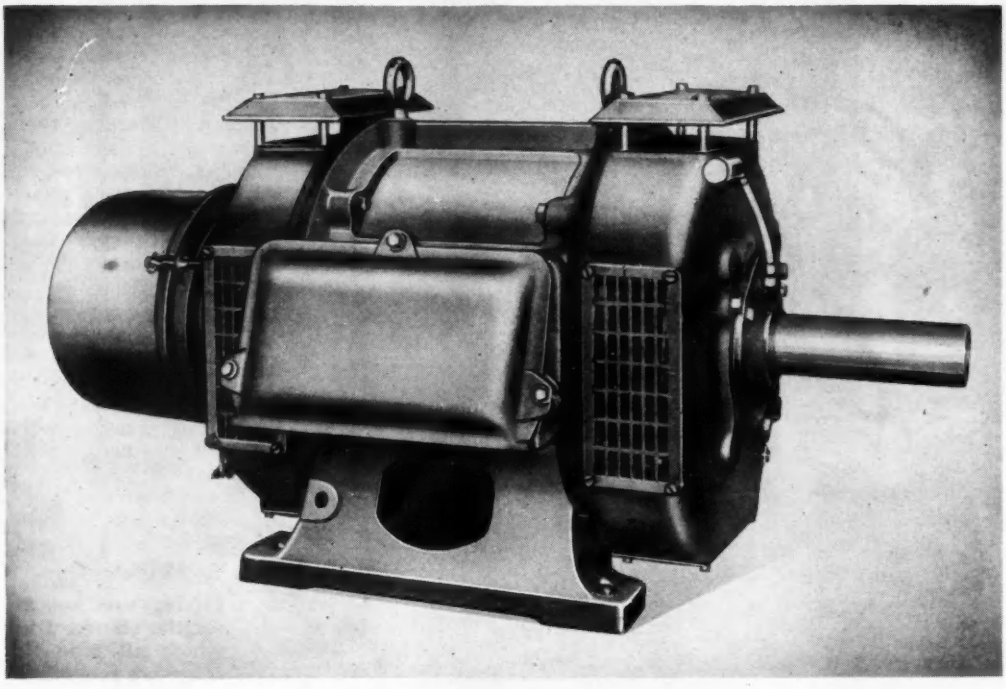

Typical of the BTH 'RS and RW' induction motors.
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Voltages: up to 6,600.

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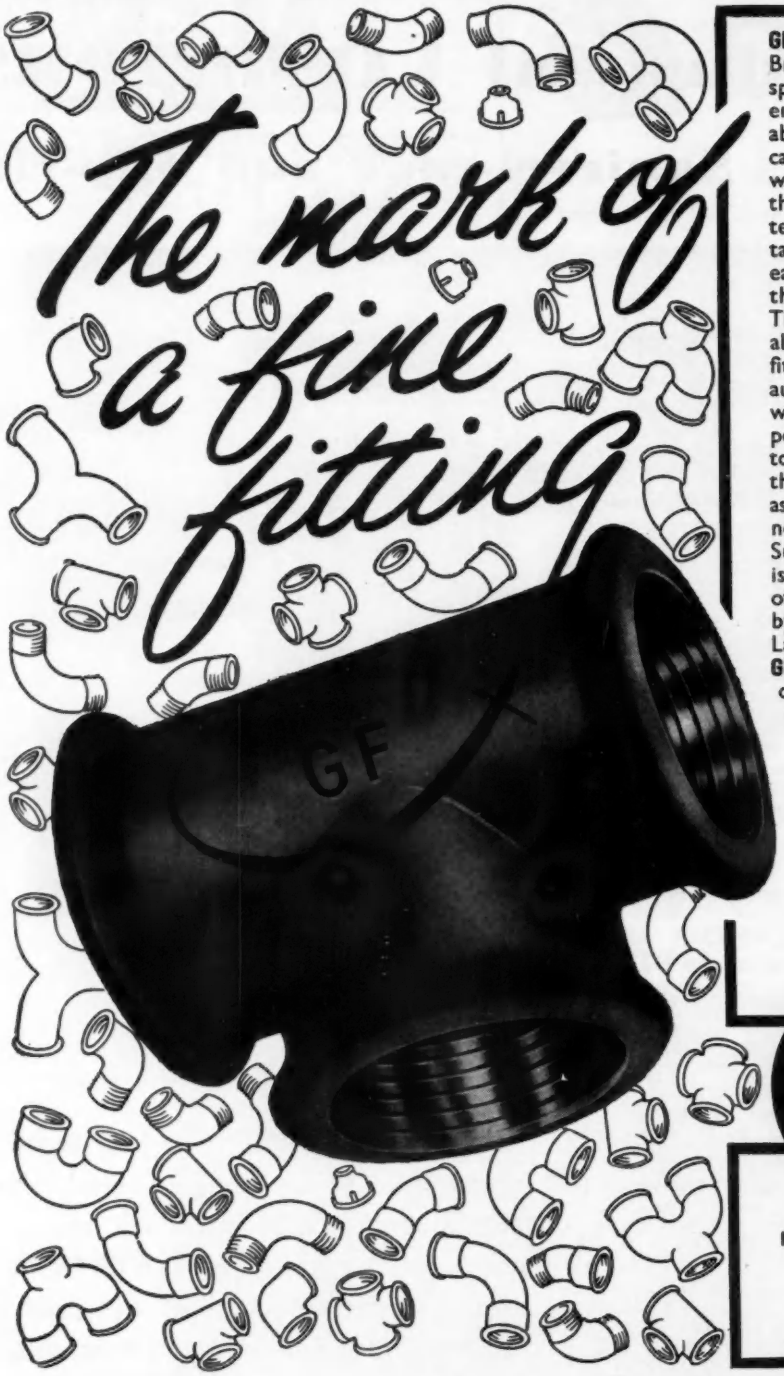
The mark of a fine fitting



GF Fittings are made from British White-Heart Iron, specially heat-treated to ensure complete malleability. Any **GF** Fitting can be hammered flat without it breaking . . . this is one of the many tests applied to samples taken at random from each batch received from the annealing shop.

The high degree of malleability achieved in these fittings ensures their automatic adjustment when assembled, for the perfect **GF** thread "gives" to the taper male thread, the bedding thus made assuring constant tightness.

Such a degree of tightness is attained by this method of fitting that when tested by the National Physical Laboratory at Teddington, **GF** Fittings proved capable of withstanding a pressure of 6,103 lb. This is an extreme — **GF** Fittings are normally tested to 360 lb. per square inch.

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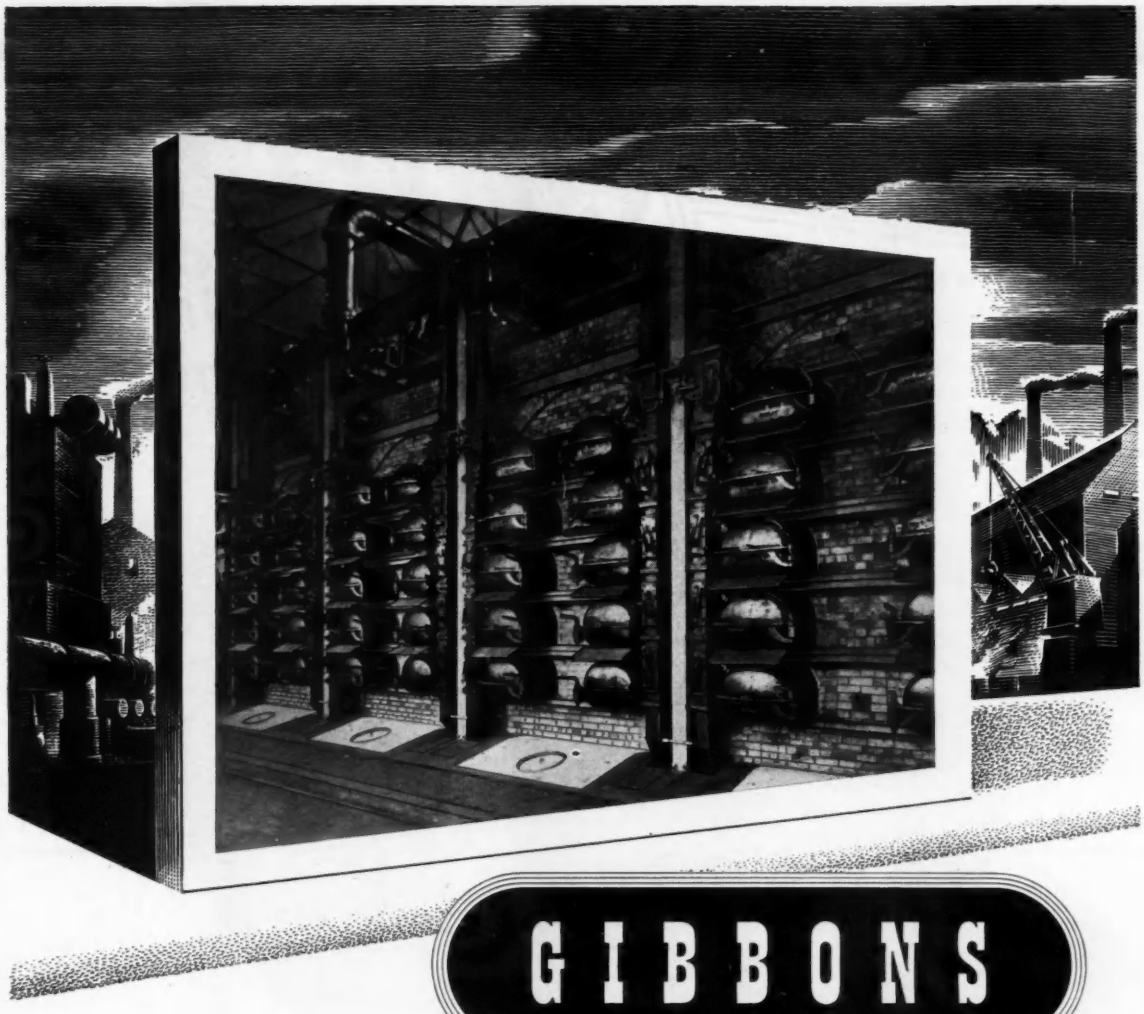

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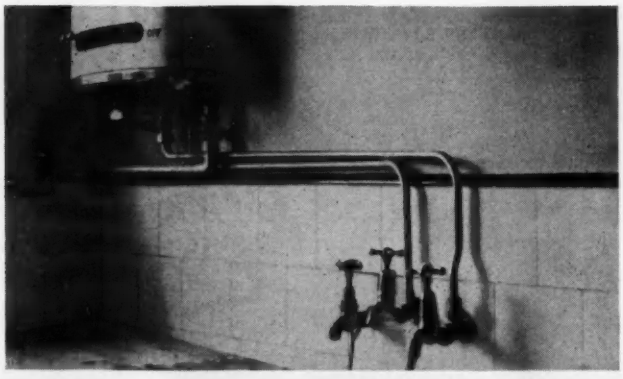

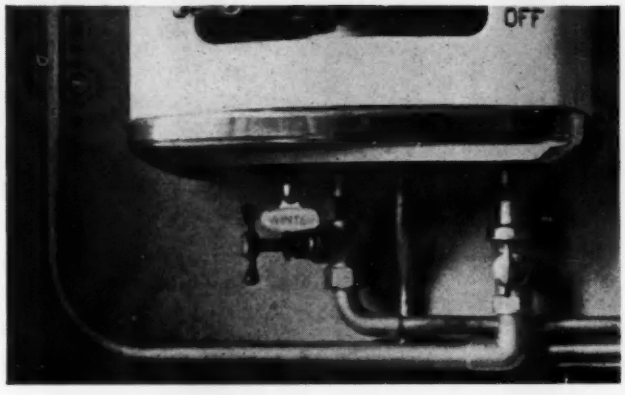

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Photographs by courtesy of The Eastern Gas Board, Tottenham Division.

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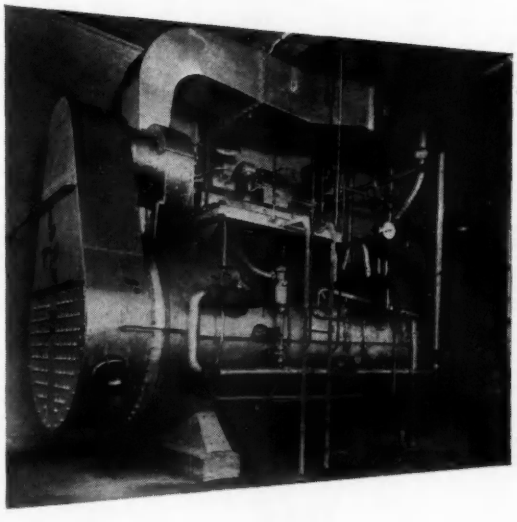

The illustration shows one of the Six Waste Heat Boilers installed at the Howdon-on-Tyne Gasworks—Northern Gas Board. Photograph by courtesy of Messrs. Gas Chambers & Coke Ovens Ltd.

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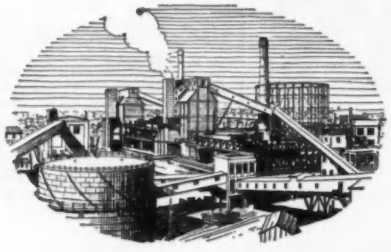

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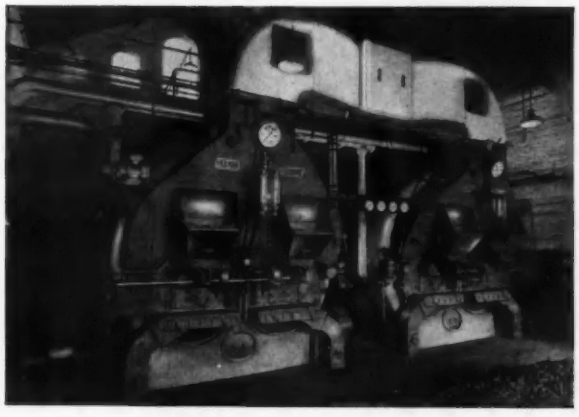

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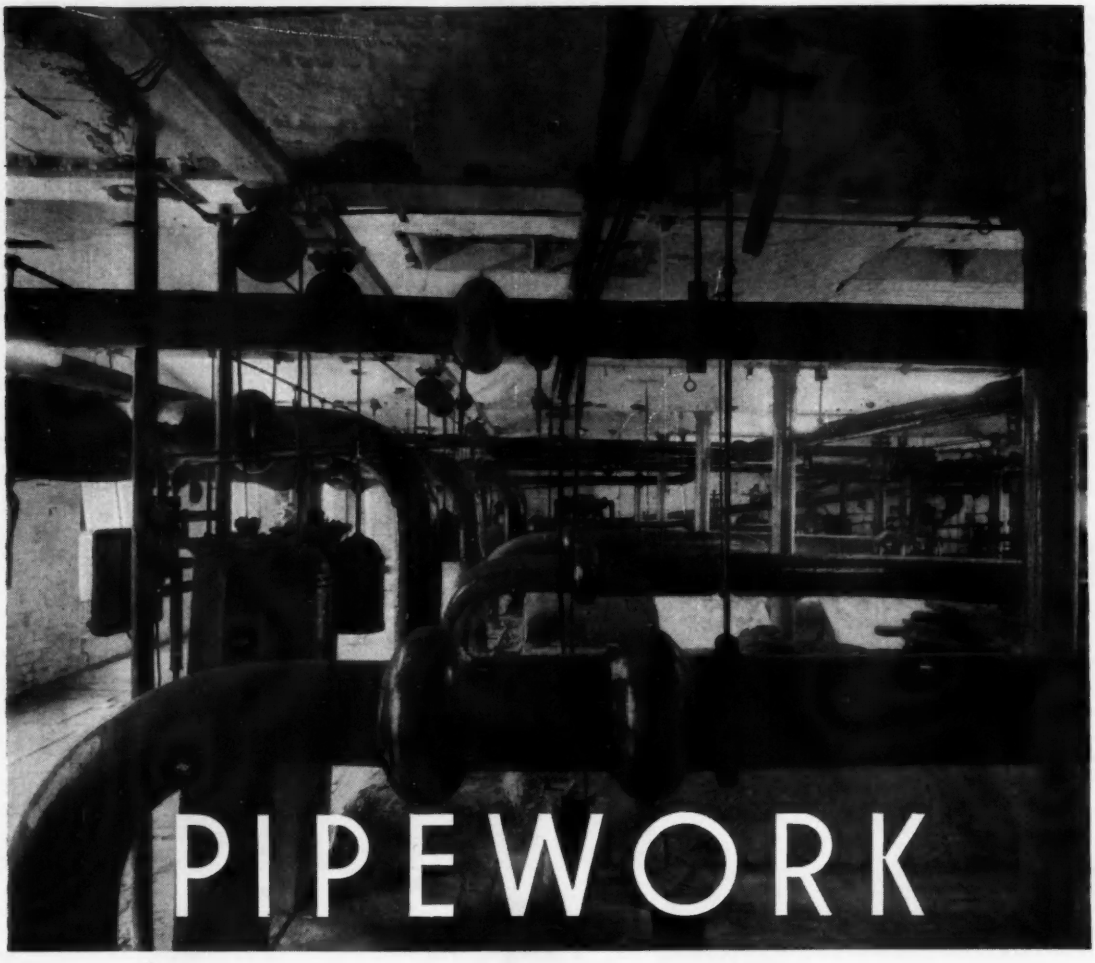

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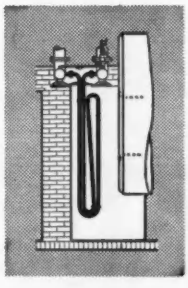

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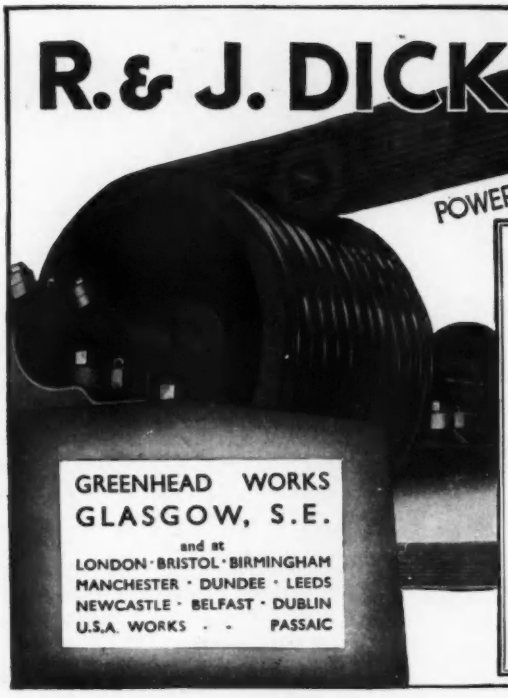

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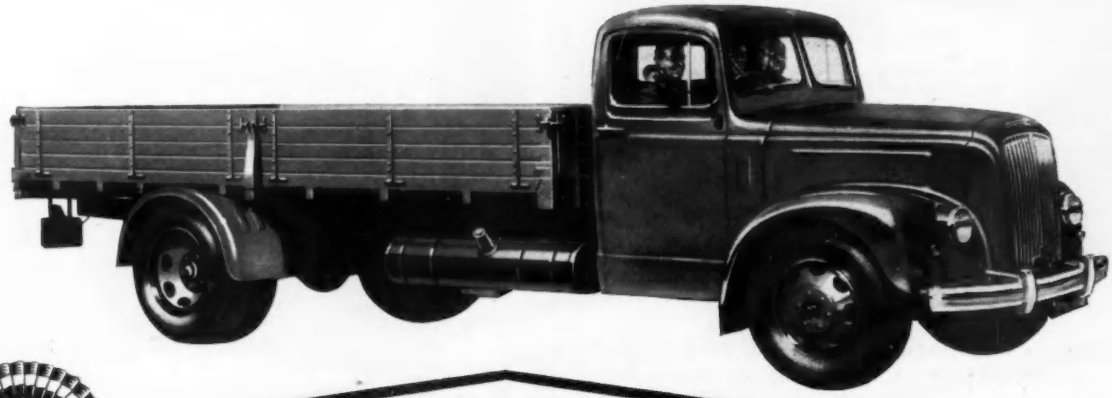

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INDEX TO 'JOURNAL' ADVERTISERS

A

	PAGE
A.C.E. Machinery, Ltd.	
Abbott, Birks & Co., Ltd.	
Accurate Recording Instrument Co.	
Acme Wringers, Ltd.	
Aerogen Co., Ltd.	
Aerograph Co., Ltd.	
Alder & Mackay, Ltd.	
Allan Taylor (Engineers) Ltd.,	
Ascot Gas Water Heaters, Ltd.	
Ascot Gas Water Heaters, Ltd. (F.A. Neat)	
Ashmore, Benson, Pease & Co	438
Ashworth, Thos., & Co., Ltd.	
Aspinall's (Paints), Ltd.	
Associated Lead Manufacturers, Ltd.	
Associated Lead Manufacturers, Ltd. (Rustodian)	
Atlas Preservative Co., Ltd.,	
Autocontrol Boilers Ltd.	
Automatic Telephone & Electric Co., Ltd.	435
Automotive Products, Ltd.	
Averill, C. R. Ltd.	

B

Bale & Church, Ltd.	485
Balfour, Henry, & Co., Ltd.	
Begwaco Meters, Ltd.	Facing p. 465
Benham & Sons, Ltd.	
Blakeley Firth, Sons & Co., Ltd.,	
Bolton's Superheater & Pipe Works, Ltd.	449
Booth, John, & Sons (Bolton), Ltd.	
Bratt Colbran, Ltd.	
Bray, George, & Co., Ltd.	436
Bray, W. E., & Co., Ltd.	
British Flint & Cerium Manufacturers, Ltd.	
British Gas Purifying Materials Co.	
British Oxygen Co., Ltd.	
British Rototherm Co., Ltd.	
British Thermostat Co., Ltd.	
British Thomson Houston, Ltd.	443
British Tyre and Rubber Co., Ltd.	439
British Vacuum Cleaner & Engineering Co., Ltd.	430
Broadbent, Thomas, & Sons, Ltd.	
Brockhouse Heater Co., Ltd.	
Broom & Wade, Ltd.	Cover IV
Brown, J., & Co., Ltd.	486
Bugden, Thos., & Co.	

C

Cambridge Instrument Co., Ltd.	
Cannon (G.A.) Ltd.	
Cementation Co., Ltd.	
Chamberlain Industries, Ltd.	
Chemical Engineering Wiltons, Ltd.	
Chemical & Insulating Co., Ltd.	
Cinema-Television, Ltd.	
Clapham Bros., Ltd.	
Clayton, Son & Co., Ltd.	429
Clifford Engineering Co., Ltd.	
Cohen, George, Sons & Co., Ltd.	
Concentric Manufacturing Co., Ltd.,	
Concrete Prooting Co., Ltd.	
Cort, Robert, & Son, Ltd.	427
Cox & Danks Ltd.	
Crane, Ltd.	
Crone & Taylor, Ltd.	
Crosby & Co., Ltd.	
Crossley Bros.	
Curtis, A. L., & Co.	436
Cutler, Samuel, & Sons, Ltd.	474

D

Davenport Engineering Co., Ltd.	
Davey, Paxman & Co., Ltd.	448
Dawe Instruments, Ltd.	
De la Rue, Thomas, & Co., Ltd. (Gas Group)	
Dempster, R. & J., Ltd.	425
Dempster, Robert, & Sons, Ltd.	471
Derbyshire Silica Firebrick Co., Ltd.	
Diaphragm & General Leather Co., Ltd.	
Dick, R. & J., Ltd.	450
Donkin (The Bryan) Co., Ltd.	Cover II
Douglas, Robert M., (Contractors), Ltd.	
Douglas, William, & Sons, Ltd.	
Drakes, Ltd.	
Drew, H. B., Ltd.	
Dunlop & Ranken, Ltd.	
Dunlop Rubber Co., Ltd., (Gen. Rubber Goods Div.)	

E

E.B. Refractory Cement Co., Ltd.	
Easiclene Porcelain-Enamel (1938) Ltd.	451
Edgar, William, & Son, Ltd.	
Elcontrol, Ltd.	
Electroflo Meters Co., Ltd.	
Electrolux Ltd.,	
Elliott Bros. (London), Ltd.	
English Electric Co., Ltd.	
Ether, Ltd.	
Evershed & Vignoles, Ltd.	
Evode, Ltd.	
Ewart Chainbelt Co., Ltd.	
Expanded Metal Co. Ltd.	

F

F. C. Construction Ltd.,	
Fibreglass, Ltd.	
Flavel, S., & Co., Ltd.	426
Fluxite, Ltd.	455
Fowler, John, & Co. (Leeds), Ltd.	
Franki Compressed Pile Co., Ltd.	
Fraser & Chalmers, Engineering Works	
Fry's Metal Foundries, Ltd.	441
Fyffe & Co., Ltd.	

G

Gas Chambers & Coke Ovens, Ltd.	
Gas Purification & Chemical, Ltd.	485
General Descaling Co., Ltd.	
General Electric Co., Ltd.	
General Gas Appliances, Ltd.	
Gibbons Bros., Ltd.	445
Gibbons (Dudley), Ltd.	
Gibson, John, & Son, Ltd.	
Glover, George, & Co., Ltd.	
Glover, Thomas, & Co., Ltd.	456
Godfrey, Sir George, & Partners (Industrial), Ltd.	
Goodall Clayton & Co., Ltd.	450
Goodyear Mechanical Goods	
Grant & West, Ltd.	
Graphite Products, Ltd.	
Green & Boulding, Ltd.	485
Gunite Construction Co., Ltd.	448

H

Hamilton, A. H., & Co., Ltd.	
Hardman & Holden, Ltd.	
Harris & Pearson, Ltd.	450
Harrisons (London) Ltd.,	486
Harvey, G. A., & Co. (London) Ltd.	
Hick Hargreaves & Co., Ltd.	
Hilmor, Ltd.	
Hills (West Bromwich) Ltd.	
Holmes, W. C., & Co., Ltd.	487
Honeywell-Brown, Ltd.	
Horseley Bridge & Thomas Piggott, Ltd.	
Horstmann Gear Co., Ltd.	
Howden, James, & Co., Ltd.	
Humphreys & Glasgow, Ltd.	431

I

Ideal Boilers & Radiators, Ltd.	433
I.C.I., Ltd. (Metals Division)	
Inertol Co. Ltd.	
Ingham, John, & Sons, Ltd.	
International Combustion, Ltd.	

J

Jeavons, E. E., & Co., Ltd.	
Jeavons Engineering Co.	
Jenkins, W. J., & Co., Ltd.	
Jobling, James A., & Co., Ltd,	

K

Keay, E. C. & J., Ltd.	442
Keith Blackman, Ltd.	488
King, Geo. W., Ltd.	
King, Walter, Ltd.	485, 486
Kings Patent Agency, Ltd.	
Kirk & Co. (Tubes), Ltd.	
Kirkham Hulett & Chandler, Ltd.	

L

LaFarge Aluminous Cement Co., Ltd.	
Laidlaw, R., & Son (Edin.), Ltd.	
Lamont, James H., & Co., Ltd.	
Lanarkshire Bolt & Rivet Co., Ltd.	
Lancashire Dynamo & Crypto, Ltd.	
Le Bas Tube Co., Ltd.	444
Lionweld, Ltd.	
Lind, Peter, Ltd.	

M

Macpherson, Donald, & Co., Ltd.	
Magnetic Valve Co., Ltd.	
Main, R. & A., Ltd	
Marco Conveyor & Engineering Co., Ltd.	
Mehlham Silica Fire Brick Co., Ltd.	
Mercol Products, Ltd.	442
Messenger & Sons, Ltd.	
Metropolitan Leather Co., Ltd.	434
Milnes Meters, Ltd.	
Mitcham Smelters, Ltd.	486
Mitchell, H., & Co.	442
Moler Products, Ltd.	440
Monk, A., & Co., Ltd.	
Morgan Crucible Co. Ltd.	
Morris Commercial Cars, Ltd.	452

N

National Benzole Co., Ltd.	
National Enamels, Ltd.	
New Conveyor Co., Ltd.,	
Newton Chambers & Co., Ltd.	
Norwest Construction & Co., Ltd.	
Nu-Swift, Ltd.	485

O

Oakland Metal Co., Ltd.,	
Olding, Jack, & Co., Ltd.	
Oxley Engineering Co., Ltd.	

P

Parkinson & Cowan (Gas Meters), Ltd.	456
Parkinson Stove Co., Ltd.	
Pass, E., & Co., Ltd.	426
Peckett & Sons, Ltd.	
Peebles & Co., Ltd.	
Pegson, Ltd.	430
Perl Controls, Ltd.	
Plus Gas Co., Ltd.	
Pollock & Peel, Ltd.	
Power Gas Corporation, Ltd.	438
Pratt Engineering Co.	
Press, William, & Son, Ltd.	
Pulsometer Engineering Co., Ltd.	

R

R.T.S.C. Home Sales Ltd.	
Radiant Heating, Ltd.	
Radiation, Ltd.	472, 473
Rawlplug Co., Ltd.	
Reavell & Co., Ltd.	432
Richmond Welding Co.	
Riley, A. J., & Son, Ltd.	454
Roberts, R. E., & Sons, Ltd.	
Robinson, J. H., & Co. (Liverpool), Ltd.	
Royles, Ltd.	
Royston, Geo., & Son, Ltd.,	
Russell Bros., (Walsall), Ltd.	
Russell, R., & Sons, Ltd.	

S

Salter, T. E., Ltd.	
Saunders Valve Co., Ltd.	
Scottish Non-Ferrous Tube Industries, Ltd.	448
Senior Economisers Ltd.	
Service Electric Co., Ltd.	
Siebe Gorman & Co., Ltd.	
Sigma Instrument Co., Ltd.	
Simon-Carves, Ltd.	
Simon, Richard, & Sons, Ltd.	
Sisson, W., & Co., Ltd.	
Smith Meters, Ltd.	
Smith, Thos. & Sons (Rodley), Ltd.	
Southalls (Birmingham) Ltd.	
Spence, Peter, & Sons, Ltd.	428
Spencer Bonecourt, Ltd.	447
Sperryn & Co., Ltd.	
Stanton Ironwork Co., Ltd.	
Staveley Iron & Chemical Co., Ltd.	
Stein, John G., & Co., Ltd.	
Stelcon (Industrial Floors), Ltd.	
Stewart & Gray, Ltd.	
Stewarts & Lloyds, Ltd.	Cover I
Stoves, Ltd.	
Strachan & Henshaw, Ltd.	
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Sutcliffe Speakman & Co., Ltd.	
Sutherland, A. G., Ltd.	

T

Thomas & Bishop, Ltd.	
Thomas (Richard) & Baldwins, Ltd.	
Thompson, John, Conveyor Co.	
Thorp, Thomas, & Co., Ltd.	
Tubela Engineering Co., Ltd.	
Tucker Eyelet, Geo., Co. Ltd.,	440
Tully, Sons & Co., Ltd.	
Turners Asbestos Cement Co., Ltd.	

U

Underpressure Engineering Co., Ltd.	
United Kingdom Construction & Engineering Co., Ltd.	

V

Vale, Thomas, & Sons, Ltd.	
Visco Engineering Co., Ltd.	
Vulcan Stove Co., Ltd.	

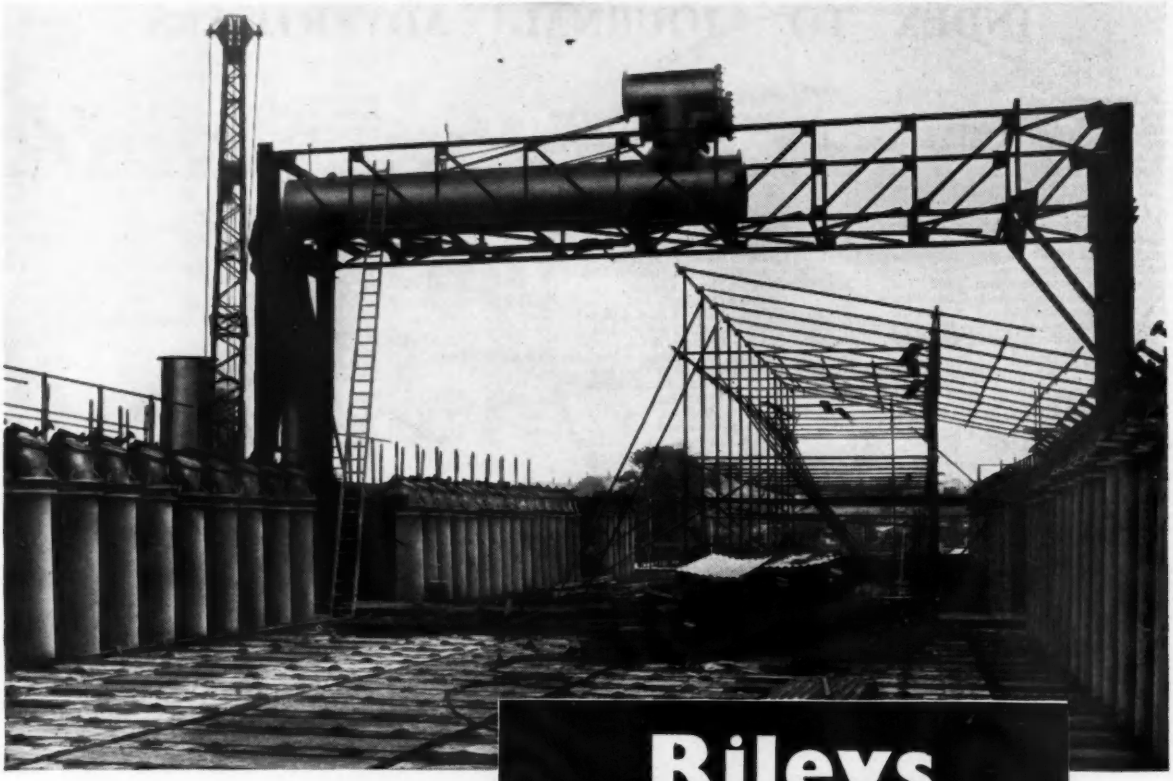
W

Wakefield, C. C., & Co., Ltd.	
Wakelin, F. H., Ltd.	
Walker, C. & W., Ltd.	474
Walker, Crosweller & Co., Ltd	
Waller, George, & Son, Ltd.	
Ward, Thos. W., Ltd.	
Warsop Power Tools Ltd.	
Weatherill, F. E. Ltd.,	
Wellington Tube Works, Ltd	
Wellman Smith Owen Engineering Corpn., Ltd.	
West's Gas Improvement Co., Ltd.	Cover III
West Hunwick Silica & Firebrick Co., Ltd.	
West's Piling & Construction Co.	
Westwood & Wrights, Ltd.	
Wheatsoe, Ltd.	
Wilkes, A. H., & Co., Ltd.	440
Willey & Co., Ltd.	
Williams, John E., Ltd.	
Williamson Cliff, Ltd.	432
Wilson, George, Gas Meters, Ltd.	437
Winn & Coales, Ltd.	
Woodall-Duckham Vertical Retort & Oven Construction Co. (1920), Ltd.	Facing p. 464
Wood, Hugh, & Co., Ltd.	446
Wright, Alexander, & Co., Ltd.	

Y

Yorkshire Copper Works, Ltd.	447

Agencies	
Appointments Vacant	485
Appointment Wanted	486
Contracts Open	
Educational	
Fellowship	486
Miscellaneous	
Notice	
Patents	
Plant etc., For Sale and Wanted	486
Publications	
Repairs	



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105th YEAR OF PUBLICATION

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VOL. 275 NO. 4707 August 19, 1953

CONTENTS

	Page
EDITORIAL COMMENT	
Efficiency in the Small Works	457
Purer Air	458
Coke for the Producer	458
C.G.I. Department of Technology	459
A Liberal Education	459
PERSONAL	460
OBITUARY	460
CORRESPONDENCE	
Gas in Butts. E. Humphrey Green	460
NEWS OF CURRENT EVENTS	
Power from Peat	459
Diary	460
Parliament and the Nationalised Industries: Recommendations of the House of Commons Select Committee	461
Fuel Efficiency in Scotland	464
Northern Juniors Visit Clarke Chapman	465
Books Received	480
Fewer and Larger Tar Distilleries: Continued Trend Towards Centralisation	481
No B.I.F. Chemical Stand	482
Launch of the Thomas Livesey	482
A.P.L.E. Exhibition	482
Gas Sales and Service Conference: To go to Southport in 1954	483
Colonial Students in Britain	483
W.G.F. Visits De La Rue Works	483
Gas Council Chairman in East Midlands	483
Company News	484
News in Brief	484
FEATURE ARTICLES	
Open-Air Swimming Pool at Spalding: Water Heating by Gas	465
Open Governor Installation at Birkenhead	467
TECHNICAL RECORD	
Cleaning of Gas Mains. Donald G. Wilkinson, District Distributing Engineer, Liverpool Group	466
Intermittent Space Heating. D. R. Wills, North Thames Gas Board, Watson House	468

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GAS JOURNAL

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EFFICIENCY IN THE SMALL WORKS

It has more than once been pointed out that it is not necessary, as it is in connection with electricity generation, to increase the size of gas manufacturing plant beyond a modest capacity to secure high thermal efficiency. A glance at Fig. 3, *King's Manual*, Section 1, will show that the curve of fuel consumption, for instance, reaches the horizontal at a daily production of 2.5 mill. cu.ft.; it does rise, however, by roughly 5% at 1.5 mill. and another 11% at 0.5 mill. As Mr. E. S. Williams points out in his very interesting paper, 'Factors Influencing Small Works Efficiency,' given to the Eastern Junior Gas Association (*Journal* of July 29, p. 278), this is mainly due to the proportionately large area of setting brickwork exposed to the atmosphere with consequent high loss of heat by radiation, a loss which can only partly be checked by insulation.

Four vertical retorts of the smallest standard size would deal with an annual demand of 50 to 75 mill. cu.ft. In several instances they have been set in single units with a division wall between—an improvement in some respects over a setting in pairs—but even so the fuel consumption at anything like 475 B.Th.U. would not be more favourable than the figures mentioned by Mr. Williams. At the same time there would be considerable advantages over horizontal retorts where capacity permitted. Labour, for one thing, even if some form of stoking machinery were used for the latter, would be less strenuous—less unattractive in a difficult market. In these days of labour amenity this advantage should outweigh the somewhat greater need of skilled technical control, a need which could be met, under the present regime, to a considerable extent by periodical visits of the technical and scientific staff of the divisional organisation which would have the immediate supervision of the small works in its area. The lower limit for the continuous vertical retort is probably something like an annual capacity of 50 mill., mainly on account of capital cost. But some of the smallest units of intermittent verticals have proved successful, and it is probable that finality in this direction has not yet been reached. Some of the difficulties with horizontal retort operation listed in the paper—floors, tools, and equipment out of repair—would seem to be easily and cheaply obviated under competent supervision.

It still appears not to be generally recognised that a large range of flexibility can be obtained by varying the output of the continuous vertical. The range depends to a great extent on the properties of the coal carbonised, but results have been published showing that with some quite standard gas-making coals retort output can be reduced for short periods by 30 to 50%, enough to deal with weekly variations in demand without standing retorts off and with a very slight loss of thermal efficiency. In such instances, steaming is not reduced without also checking rate of coke extraction, a point too often missed in discussions of retort house practice.

It is good to note that Mr. Williams deprecates the use of excessive steaming in the effort to deal with a rush of load. In every case the steam injected must be the minimum in proportion to throughput to attain the calorific value required. If these two factors are correctly co-regulated it should not be necessary to resort to outside gases for dilution, unless, of course, more gas is required than the retorts themselves are capable of producing.

Mr. Williams' remarks on instrumentation are wise and welcome. While efficient operation requires a sufficiency of instruments, so that the operator may know what he is doing, and of recording instruments so that supervision may be possible, extensive instrumentation is not advocated. Indeed one wonders whether even Mr. Williams' schedule is not too long. Is a pressure-vacuum recorder for producer gas altogether justified? It is difficult enough to keep a pressure here—that is, without pressure equipment—so that as long as a quite small pressure is maintained at inlet to settings it should be regarded as satisfactory, and this state of things is readily ascertained by visual inspection.

An important point about instruments is that unless they can be adequately maintained they are worse than useless. For this reason, apart from that of first cost, the instruments installed in the small works should be few in number, simple in action, and robust in construction. For control of calorific value the Sigma indicator is adequate. The recorder is justified if it also serves such additional purpose as that of the gas examiner. Cannot the checking with an approved standard calorimeter be done by the travelling laboratory of the division? The great importance of correct pressure conditions at retort offtake will justify the provision of a

recorder here. But it should be combined with an indicator and installed near to the retort tops. The vacuum recorder for exhauster pull may also be justified, but should not this be placed in the exhauster house? The temperature and pressure gauge panel, a centralisation of instruments, is all very well as long as the indicators are not too far from the operator when he is making his adjustments. It is a pity that weighing machines for coal and coke in the retort house are too expensive for the small works. They are omitted, we think unwisely, in some quite large installations.

The author's remarks on purification, wet and dry, will also command the assent of most operators. The suggestion that the electro-detarrer should be embodied in the equipment of quite small works is very interesting. But what is the limit below which purifier rotation is not always possible? The development of the use of ammoniacal liquor in agriculture should be the aim of most small works. They are often surrounded by arable land where it has been shown that liquor can be profitably employed, both fed direct to the land and for breaking down straw and vegetable refuse into humus. An obvious difficulty is that of accommodating continuous production to intermittent demand. The advocacy of positively controlled admission of air to oxide purifiers, even for small works, will be noted with approval.

One cannot but admire the vigorous, optimistic tone of this paper. Reading it, one must keep distinct the two meanings of the word 'efficiency'—one the ratio between output and input, the other general effectiveness and competence. Too often in the past the small works has been abandoned to relatively unskilled control.

PURER AIR

For eighty-nine years the Chief Inspectors under the Alkali, Etc., Works Regulation Act, and their predecessors operating under earlier legislation, have striven to preserve the purity of the atmosphere against harmful emissions of increasing variety from industrial establishments. Their latest reports, which we summarise on a later page, reminds us that while, in specified works, escapes of acid gases must not exceed a certain stated concentration, the normal requirement is that the best practicable means shall be employed so that offensive gases are either eliminated or rendered harmless and inoffensive. There is no well-defined line between legitimate and illegitimate operation, and decision whether a given set of conditions constitutes an infraction rests with the inspectors. In 1952 there was no recourse to the penal clauses of the Act, remedial steps having been promptly taken and suitable assurances given in regard to all infractions recorded.

The arrangement announced last year under which the alkali inspectors keep in touch with the development of projects for the building of new gasworks has continued, and there has been consultation with the area boards on these matters. From information received it is apparent that full consideration is given to the necessity of keeping noxious or offensive emissions to a minimum. So far as tar works are concerned, the trend towards concentration of increased tar distillation activities in fewer and larger works has continued, the tar distilled last year being half as much again as it was 20 years ago. The report says that on the whole 1952 was a satisfactory year with conditions progressively improving as continuous units have replaced intermittent stills. The standards of cleanliness and of good housekeeping are much higher than they were a few years ago. Concentration of operations at the central establishments has led to some of the smaller works reporting increasing difficulties in obtaining supplies of crude tar for distillation.

Discussing smoke from industrial furnaces Mr. W. A. Damon refers to the substantial reduction of atmospheric pollution by smoke in the Potteries in spite of increased production of ware, due to the greater use of gas (and electricity) instead of coal for heating pottery kilns. Quoting from a paper by K. Davis to the Midland Junior Gas Association he points out that gas consumption for the actual firing of pottery rose from 36¾ mill. cu.ft. in 1933 to approximately 4,600 mill. cu.ft. in 1952; a further 1,000 mill. cu.ft. were used for other processes connected with the pottery industry. Consumption of electricity for heating ceramic kilns rose from 5 mill. units in 1933 to 14 mill. units in 1941, and after a wartime slump there was a sharp rise to 60 mill. units in 1952. A spokesman of the British Pottery Manufacturers' Federation said recently that whereas the pottery industry used 1 mill. tons of coal per annum before the war the consumption is now reduced to approximately 400,000, due to the change over from coal to gas and electric firing. The legislative position in Scotland was brought more closely into line with that in England as the result of the Alkali, Etc., Works (Scotland) Order, which came into force 12 months ago. As in England and Wales, Mr. E. A. B. Birse, Chief Inspector for Scotland, found it possible to deal with all the infringements recorded during the year without recourse to prosecution. Concentration of ammoniacal gas liquor in Scotland remained on a small scale of working owing to continued lack of a good market. Mr. Birse adds: 'With the day approaching when a higher standard for effluent discharge to rivers will be required the problem of finding a use for ammoniacal liquor becomes more important.'

COKE FOR THE PRODUCER

In the small or medium sized works where coals of low coking value must for geographical reasons be carbonised, a very great problem arises in the properties of the coke available for producers. In his paper, 'Coke and Step-grate Producers,' presented to the Scottish Juniors (*Journal* of July 29 last, p. 277), Mr. J. Watson dealt with some of these. The chief difficulty is the small size of the fuel fed to producers, aggravated by a lack of uniformity in grading. An American technician once said he would design and operate a producer successfully with ¼-in. fuel provided that the fuel remained pretty accurately to that grading. 'The more uniform in size the fuel the more readily can the producer be operated in a satisfactory manner,' said Mr. Watson, quite rightly, but the reason for this is not that stated in the immediate context but further on in his paper where he remarks on the effects of segregation. Any variation in the density of the fuel bed promotes channelling, with obvious results.

Selection of coals to obtain satisfactory producer fuel would appear to be desperate remedy indeed. Much more data than that given in the paper would be

necessary to show whether the measures described were justified economically or technically. Or were they merely dictated by necessity? Selection and preparation of coke for producer use may be justified in some cases. Mr. M. S. Gaskill has shown ('Fuel Economy in the Gas Industry,' *Journal* of June 4, 1952) that in one instance in Scotland fuel consumption in terms of dry coke was reduced from 14 to 12.5% by debreezing the coke to producers. But of course the use of such a coke-breaker as the rotary screen for this purpose was not contemplated. There are several excellent debreezing screens in the market at a reasonably low price.

Nothing was said by Mr. Watson about pressurised step-grate producers. The claim that the pressurised step-grate will use breeze economically is not now pressed, but one would think there is little doubt that the addition of a simple form of pressure device to Mr. Watson's producers would reduce his troubles. And there seems to be no reason why a dust-settling chamber should not be added even though its 'efficiency' might be something less than 100% dust removal.

It would therefore appear to be something less than fair to say that 'too little scientific approach has been made to step-grate producer design and operation.' The wide gulf is rather between the considerable volume of experience and data and its adoption in the layout and operation of plant. As Mr. Gaskill pointed out the gas industry is a not inconsiderable consumer of fuel. The annual consumption of coke in producers alone is of the order of 4 mill. tons. He suggests that there is in many instances a possibility of economy in the use of this quantity of fuel. Mr. Watson's difficulties indicate that such possibilities will be conditioned by the properties of the coals available and the coke resulting from its carbonisation.

C.G.I. DEPARTMENT OF TECHNOLOGY

The Department of Technology of the City and Guilds of London Institute has issued its report for 1952, recording that the outstanding event of the year was the yearly meeting last November. In the presence of the Lord Mayor and a distinguished company of members and guests, the Duke of Edinburgh, President of the City and Guilds of London Institute, took the chair and presented diplomas to the newly-elected Fellows of the Institute and warrants to those on whom Foundation Insignia Awards had been conferred. The Council has made an ordinance under its charter establishing the City and Guilds of London Institute Insignia Award in Technology. Conditions governing the award are that the applicant shall be not less than 30 years of age; shall have completed a period of apprenticeship or practical training followed by at least seven years of suitable industrial experience; shall hold a full Technological Certificate; and shall show that he has continued the study of his particular branch of industry and developed a critical appreciation of its problems and a capacity for leadership and administration.

The Insignia Award is intended for those whose training has been based primarily on practical experience combined with theoretical study, rather than on the more academic approach for which adequate awards and qualifications already exist. It is hoped that the establishment of this award will encourage those who have completed a course of training of the kind intended by the Department's schemes to extend their studies to the broader problems of their particular industry and to widen their knowledge of the scientific principles inherent in it. Presentations of the Insignia Award will be made annually by the Council of the Institute and those who receive it will be authorised to use the insignia letters C.G.I.A. The Institute conferred Foundation Insignia Awards on 11 persons who had attained distinction in their respective industries, and whose careers in their earlier stages followed the pattern of practical experience allied to theoretical study.

The report of the Council of the C.G.I. says the problem of accommodation for the Department of Technology remains unsolved and is seriously hampering the department's work. Suitable accommodation, conveniently located and on one site, would obviously ease administration and lead to appreciable economies. It is a matter of grave concern to the Council and one which must have a prior claim on any increased financial resources. This lack of adequate accommodation for the Department of Technology has on several occasions found the Institute without meeting places for the departmental advisory committees.

A LIBERAL EDUCATION

Writing in the *Journal of the Engineers' Guild*, Reginald O. Knapp, Professor Emeritus, University of London, refers to the clamant need for many more highly skilled specialists in a great variety of technical fields. This will require greater facilities for intensive vocational training, but the attitudes of mind which are characteristic of the more liberal education of our universities will remain indispensable for breadth of vision, flexibility of mind, and for the exercise of wisdom rather than the application of knowledge. And a degree course in a technological subject as given in most British universities is, in Professor Knapp's opinion, more liberal than can be found anywhere else. It emerges from the Productivity Report on Universities that was recently presented by a team of visitors to the United States of America, that a technological degree in the U.S.A. is obtained after training in a far narrower field. It is true that one or two humanistic subjects are sometimes grafted on to the course; but that hardly suffices to turn an intrinsically narrow field into a wide field of study. To say that, in our British faculties, training in arts and science is far less liberal than in engineering is to be met with incredulity. But, comments Professor Knapp, observation of the work done in those faculties is convincing that it is so. Compared with the engineering graduate, the graduate in French, say, or history, or botany, or physics, studies a most limited range of subject. As he goes from one lecture to the next he does not go, as the engineering student does, from one mental discipline to another. He remains in the same field of study, the field with which his speciality is concerned. To him but one world of thought is revealed, though it be in great detail. By contrast the engineering undergraduate is given glimpses of worlds beyond worlds.

POWER FROM PEAT

MR. JAMES STUART, Secretary of State for Scotland, has announced that the preparation of the report of the initial investigations into the possibility of using peat deposits to generate electricity is now well advanced. Meanwhile the setting-up of an experimental peat-burning power station at Altnabraec, Caithness, the recommendation of which has been accepted by the Development Commissioners and the Treasury, will be commenced at once. The plant will consist partly of a 2,000 kW closed-cycle gas turbine of the type developed by John Brown & Co., who, in conjunction with the North of Scotland Hydro-Electric Board, have been working on turbines of this type since 1947. In addition, the scheme will include a 750 kW open-cycle turbine manufactured by Ruston & Hornsby to the order of the Ministry of Fuel and Power. It will be installed when the necessary tests have been completed. The pilot scheme will take three to four years to construct.

Personal Notes

SIR WALLACE AKERS, C.B.E., F.R.S., has been appointed by the Minister of Fuel and Power to be a part-time member of the Southern Gas Board. He was until April this year a director of Imperial Chemical Industries, Ltd. He was Director of Atomic Research, 1941 to 1946.

MR. W. E. SETTLE, of Crossley Brothers, Bispham, and John E. Williams & Co., Ltd., Partington, has been ill for the past few weeks. His many friends in the gas industry will be pleased to know that he is recovering, but it will be some time before he resumes full activity.

MR. W. BOWDEN has been appointed by the British Tyre & Rubber Co., Ltd., as Group Chemist, MR. W. GLOVER succeeding him as Works Chemist at the company's Leyland factory. MR. C. H. HOLYOAK has been appointed Group Works Accountant. MR. H. ACKERS becomes Deputy Works Superintendent of the Leyland factory.

MR. R. GRAHAM EMERY, Group Sales Manager of the National Benzole Co., Ltd., has just completed 30 years with the company. Joining as a Sales Representative in the London Division, he was appointed assistant divisional superintendent in 1926. In the following year he became divisional superintendent, and was transferred as divisional manager, South Midland, in 1928, and to Lancashire in 1935. During the last war he was Liaison Officer of the Petroleum Board with the Ministry of Fuel and Power at Newcastle-on-Tyne.

MR. J. H. PITCHFORD and Professor S. ZUCKERMAN have been appointed by the Minister of Fuel and Power to be members of the Scientific Advisory Council, which was set up in 1948 to advise the Minister on the scientific aspect of his statutory duties. Mr. Pitchford is Managing Director of Ricardo and Co., Engineers (1927), Ltd. He is an authority on industrial research, particularly in the field of diesel engine design. Professor Zuckerman, who served on the Council from its inception till June, 1952, is Sands Cox Professor of Anatomy at Birmingham University.

MR. A. PICKARD, Engineer, Manager, and Secretary of the Llanelly and Gowerton undertakings of the Wales Gas Board, has been appointed General Manager of the Swansea undertaking, to succeed MR. E. ABLETT, who will retire on January 1, 1954. Mr. Pickard was educated at King Edward VI Grammar School, Pontefract. He secured a first class Diploma in Gas Engineering (Manufacture) with distinction in Gas Supply. After serving Knottingley Gas Company he was appointed in June, 1942, Engineer, Manager, and Secretary of the Llanelly undertaking, and in 1944 he took up the additional appointment of Engineer and Manager at Gowerton. In 1952 he was the first representative of the gas industry to attend the three months residential course in top management and administration at the Administrative Staff College, Henley-on-Thames. He was Chairman of the Wales and Monmouthshire District Section of the Institution of Gas Engineers in 1952, and is Secretary of the Education Committee of the Wales Gas Board.

MR. A. E. BAGG has left Industrial Guarding Equipment, Ltd., to take up an appointment as Managing Director of Press Guards, Ltd., at Farm Street, Birmingham. Well known in industrial safety and accident prevention circles, Mr. Bagg hopes to initiate a vigorous policy of expansion in his new sphere. Service facilities at existing branches in London and Manchester will be extended, and it is hoped to open other branches.

MR. W. T. NEWTON has been appointed Chief Sales Engineer of Woodall-Duckham (Australasia) Pty., Ltd., Melbourne. He was formerly Divisional Engineer in the Walsall and District Division of the West Midlands Gas Board. Prior to his engagement by the West Midlands Gas Board in 1949 he was a member of the staff of the Woodall-Duckham Company, London, for 26 years. For most of this time he was a sales engineer but also served in the operating, construction, and design departments. Mr. Newton is sailing for Melbourne, where he will reside, on September 16. His successor at Walsall, as announced in the *Journal* of July 8, is Mr. W. L. Jackson.

Obituary

MR. ALFRED T. WALLINGTON, Secretary of Smith Meters, Ltd., died on July 31 after a short illness. He joined Smith Meters, Ltd., in 1928 and was appointed Secretary in 1941.

MR. A. J. PRIVETT, Sales Manager of the Portsmouth, Gosport, and Bognor Regis undertaking of the Southern Gas Board, has died in hospital after a sudden illness at the age of 61. Mr. W. K. Tate, General Manager of the Eastern Division, writes: Mr. Privett had, when he died, rendered 40 years devoted service to the gas industry. He commenced as a junior clerk in the old Portsea Island Gas Light Company, transferring to the sales side in 1920 and progressing through the positions of showroom assistant, showroom manager, personal assistant to the sales manager and, ultimately, to the office of sales manager of the Portsmouth and Gosport Gas Company in 1946. On nationalisation in 1949 he was promoted to be Sales Manager to the Portsmouth, Gosport and Bognor Regis undertaking. He was notable, not only for his energy and devotion to duty, but also for his charm of manner, which endeared him to all with whom he came into contact. Whether he was dealing with the needs of an individual gas consumer or taking part in discussions at the highest level, one always enjoyed his company and was left with the impression that he was a complete master of his job and delighted in giving his best to the industry. Mr. Privett was a native of Fareham, and he was known to a wide circle of residents throughout the district. This, indeed, made him invaluable to the undertaking he served and he will be a real loss to us all in Southern Hampshire and, indeed, much further afield. Closely interested as he was in the welfare work and the social and athletic activities of the undertaking, the education of gasfitter apprentices and salesmen was a matter close to his heart, and his church will miss his voice (and a grand voice it was) in its services each Sunday. In his passing the Southern Gas Board has lost an outstanding officer and I have lost an excellent colleague and a true friend.

Correspondence

GAS IN BUTTS

DEAR SIR,—Your readers may be interested in an extract from a magazine published 139 years ago. The *London Monthly Magazine* for October, 1814, contained the following:—

'It affords us the highest satisfaction to be able to state that the first of practical discoveries, the means of illuminating by the gas of coal, proceeds in its application with all the success that can be desired. A new establishment has been opened in Worship Street, in addition to that in the City Road, and both manufacturies are constantly employed in evolving gas, which is preserved in butts like beer, and sent for use to any distant place at which it is intended to be consumed. Many hundred butts, besides large reservoirs, have been thus manufactured during the summer, and kept in store for the winter. Already above a mile of the public streets is enlightened by this means, besides the Houses of Parliament and many public buildings. The beauty and brilliancy of the light exceed the powers of description, and can be understood only by being witnessed.'

Yours faithfully,
E. HUMPHREY GREEN.

London Road,
Wickford, Essex.
August 10, 1953.

Diary

Sept. 1.—EAST MIDLANDS G.C.C., Victoria Station Hotel, Nottingham, 11.30 a.m.

Sept. 1.—SOUTH EASTERN G.C.C.: Gas Board offices, Katharine Street, Croydon, 2.15 p.m.

Sept. 3-9.—BUILDING PLANT EXHIBITION, organised by the Ministry of Works. Goose Fair Site, Nottingham.

Sept. 3-17.—ENGINEERING, MARINE, AND WELDING EXHIBITION (including Chemical Plant Exhibition). Gas Council exhibit. Olympia.

Sept. 9.—SOUTH WESTERN G.C.C.: 34, Bridge Street, Taunton, 11 a.m.

Sept. 10.—WALES AND MONMOUTHSHIRE SECTION, I.G.E.: Annual General Meeting, Broadcasting Hall, Trinity College, Carmarthen; Discussion on the Report of the visit of the Gas Industry Productivity Team to the United States to be opened by E. M. Edwards, Member, Wales Gas Board.

Sept. 15.—IRISH GAS ASSOCIATION: Annual Meeting, Tramore.

Sept. 15-18.—ASSOCIATION OF PUBLIC LIGHTING ENGINEERS: Annual Conference and Exhibition of Street Lighting Equipment (including Gas Council display), Liverpool.

Sept. 23.—SCOTTISH ASSOCIATION OF GAS MANAGERS: Annual General Meeting, Edinburgh.

Sept. 23.—NORTH WESTERN FUEL LUNCHEON CLUB; Address by Mr. Gerald Nabarro, M.P.

Sept. 25.—MANCHESTER AND DISTRICT SECTION, I.G.E.: Visit to Petrochemicals, Ltd., Irlam, Manchester.

Parliament and the Nationalised Industries

Recommendations of the House of Commons Select Committee

THE House of Commons Select Committee on the Nationalised Industries issued its report on August 12. The Select Committee was appointed last November to consider the present methods by which the House of Commons is informed of the affairs of the nationalised industries and to report what changes, having regard to the provisions laid down by Parliament in the relevant statutes, might be desirable in those methods. The Committee comprised Mr. A. H. Albu, Mr. R. Assheton, Mr. A. Champion, Mr. Ernest Davies, Viscount Hinchingbrooke, Mr. H. N. Linstead, Mr. P. J. Noel-Baker, Sir Patrick Spens, Colonel C. N. Thornton-Kemsley, Sir Herbert Williams, and Mr. Ronald Williams.

The Committee held 17 meetings during the present session of Parliament, and the substance of its recommendations is as follows:

(a) There should be appointed a Committee of the House of Commons by Standing Order to examine the nationalised industries, with power to send for persons, papers, and records, power to set up sub-committees, and to report from time to time.

(b) The Committee should direct its attention to the published reports and accounts and to obtaining further information as to the general policy and practice of the nationalised industries established by statute, whose controlling boards are wholly nominated by Ministers of the Crown, and whose annual receipts are not wholly derived from moneys provided by Parliament or advanced from the Exchequer.

(c) The object of the Committee should be that of informing Parliament about the aims, activities, and problems of the corporations and not of controlling their work.

(d) The staff of the Committee should consist of an officer of the status of Comptroller and Auditor General, who should be an officer of the House of Commons, with high administrative experience; at least one professional accountant, and such other staff as required.

(e) The statutory auditors of the corporations should in preparing their annual reports give such information in addition to that now provided for them as might be of use to the Committee and of interest to Parliament.

List of Witnesses

During its sittings the Committee considered evidence from Sir Frank Tribe, Comptroller and Auditor General, Mr. H. R. M. Farmer, Clerk to the Select Committee on Estimates and formerly Clerk to the Committee of Public Accounts, Lord Hurcomb, Chairman of the British Transport Commission, Lord Reith, Chairman of the Colonial Development Corporation, Mr. T. B. Robson, President of the Institute of Chartered Accountants, Sir Harold Howitt, Captain H. F. C. Crookshank, Lord Privy Seal and Leader of the House, Sir Geoffrey Heyworth, Chairman of Unilever, Ltd. (Chairman of the Committee of Enquiry into the Gas Industry which presented its report in 1945), Sir Edward Bridges, Permanent Secretary to the Treasury, Mr. Herbert Morrison, and Mr. Hugh Molson. During the previous session it had examined Sir Frederick Metcalfe, Clerk of the House, Mr. D. J. Gordon, second Clerk Assistant. Lord Hurcomb, Lord Citrine, Chairman of the British Electricity Authority, Sir Hubert Houldsworth, Chairman of the National Coal Board, Sir Thomas Gardiner, formerly Director-General of the Post Office, Captain Crookshank, and Mr. Herbert Morrison. Written communications were received from certain Members of Parliament and also a memorandum dealing with the parliamentary control of nationalised industries in France.

The present methods afforded to members of Parliament of obtaining information about the nationalised industries were summarised in a memorandum presented in the last session by the Clerk of the House. They comprise the following:—

(1) *Debate on Motions*
- (*a*) Motions specifically concerning one or more of the industries, either moved by a Minister or by some other member when the Government has given time for the debate;
- (*b*) 'Ballot motions' in private members' time;
- (*c*) Debate on the Address in reply to the Queen's Speech;
- (*d*) The daily half-hour adjournment at the close of the sitting;
- (*e*) Adjournment motions moved by a Minister for the purpose of debating a particular subject.

(2) *Debate in Committee of Supply* or on an amendment to the question 'That Mr. Speaker do now leave the Chair' (under Standing Order No. 17 (2) for Committee of Supply).

(3) *Debate on Bills* whether public or private dealing with one or more of the industries.

(4) *Debate on motions to approve or annul Orders* or other statutory instruments made by Ministers under the various nationalisation Acts.

(5) *The annual reports and accounts* of the various boards and commissions, which are laid before Parliament.

(6) *Questions to Ministers.*

In the last session of Parliament the Committee confined itself to investigating the problem of questions to Ministers as being the most immediate opportunity of acquiring information, and it reported that no major extension of the machinery of questions to Ministers was desirable.

Desire for Information

There is, no doubt, a general desire for information about the nationalised industries. The nationalised industries publish voluminous reports, but these do not completely meet the needs of Parliament or the public, partly owing to their sheer volume and complexity, and partly because information is not necessarily available on the matters on which it is required or when it is required. In the words of Lord Hurcomb, there is 'a very real problem ultimately of accountability to Parliament.' The problem of the accountability extends beyond the narrow confines of finance. Its existence was emphasised, and it was explained, by many of the witnesses before the Committee.

The need for accountability in the nationalised industries arises from the vast amount of capital. and of income and expenditure, involved in concerns which are under public ownership; the charges on consumers and users of the necessities of civilised life which they provide; and the Treasury guarantee of the interest paid on the stock issued in respect of the various nationalised industries.

A matter which also weighed in the minds of the Committee was that the nationalised industries had insufficient opportunity of presenting their case to Parliament and the public, and were exposed to public pressure in various ways and much irresponsible criticism. That there was this difficulty was confirmed by Lord Hurcomb, who said, 'One of the very greatest handicaps under which anyone in my position suffers is that he gets no opportunity of stating his own case or of explaining what are his difficulties direct to Members of Parliament' . . . . 'It has been borne on me, if I may say so, without causing offence in any quarter, in the last 18 months that a great many misapprehensions do exist, and perhaps decisions are taken on some supposition of fact which is not correct.' The possibility of political pressure was mentioned by Mr. Molson, who cited the example of the difficulties experienced by the Railway Executive in any proposal to close an uneconomic branch line.

The Committee therefore explored by what means Parliament could be better informed, and after a few meetings and some examination of witnesses, decided to examine the possibilities of setting up a Committee of the

House of Commons, or of both Houses of Parliament, as offering the natural additional means of informing Parliament of the affairs of these industries compatible with their statutory position and with constitutional propriety.'

The arguments in favour of the proposal to set up a Committee were briefly summarised in the evidence given by Mr. Molson, speaking for himself, as he was careful to point out, and not for the Government, in the following words:—

> 'In the past the House of Commons has always found it convenient, when confronted with a special problem, to appoint a committee. I think the reasons for that are threefold. First, in order that a few Members of Parliament may give intensive study to the problem; secondly, that there may be interrogation of witnesses and investigation of papers and maps; thirdly, in order that in the seclusion of a committee room there may be comparative freedom from political prejudices. . . . I believe that the committee which I am advocating should elucidate what I might call deep problems of policy. I am sure it is important to avoid day-to-day interference with detail, but there is I think a great need that from time to time Parliament should have an opportunity of taking stock.'

Continuity of Personnel

The possibility of setting up a Committee was put to Lord Hurcomb and Sir Edward Bridges, and additional arguments for the proposal were given by them. Their support was perhaps more measured, and influenced by the knowledge that the Committee was considering the proposal, and by their own experience as civil servants of the analogous work of the Committee of Public Accounts. Lord Hurcomb said, 'The sort of committee that it seems to me would do much to satisfy the very legitimate demand of Parliament for a greater knowledge than can be got in debate about the affairs of one of these great corporations, would be something in the nature of a standing committee, so that there would be continuity of *personnel*—a group of members who took a special and continuing interest in a particular activity, not merely because it was nationalised, but more from the actual interest that the committee has in the subject.' He went on to say that 'A committee of this sort would, or ought to, mean on that aspect, as these matters get further away from the highly controversial, that a large number of Members of Parliament would have an opportunity of satisfying themselves and conveying, not by way of attack and of public speech, but by way of suggestion, to the organisation, the points where they thought something might be going wrong, or, at any rate, would be worth looking into. That would be of great value.'

It was strongly represented that the proposal to set up a permanent committee of enquiry into the nationalised industries was not only contrary to the spirit and intention of the Acts under which the industries were nationalised, but an innovation in and hostile to the general pattern of the British constitution. As Lord Reith said, 'I should have thought the appointment of a select committee, *ad hoc*, on a nationalised industry was in effect a negation of what Parliament deliberately did in setting it up. Parliament passed a sort of self-denying ordinance taking from itself the right of direct interference, as with Government departments. Unless there is to be a revision of attitude, I would have thought it was contrary to the principle of what was done that you should set up a committee whether of one House or both. . . . It would seem a sort of institutionalisation of the Parliamentary question, the very thing Parliament denied itself.' The argument expounded by Lord Reith would appear to apply even more strongly to a permanent select committee.

The same argument was enlarged by Mr. Hebert Morrison. Later, in the course of his evidence, he adduced a more fundamental objection. When he was asked 'Really your objection to the select committee is not only to its possible ineffectiveness, but also that it is not perhaps the function of Parliament to intervene on the efficiency side to the extent which is envisaged by a select committee going into it?', he answered, 'I would die for Parliament —I have an enormous admiration for it—but I do not think it is the kind of body to which you could entrust this to the point of alteration of the actual management of a complex industrial concern.'

Another argument against the proposal was that a committee would raise the whole question of the responsibility for managing and directing the operations of the public corporations. If a select committee were constantly enquiring into the policy and operations of the corporation, it would necessarily cause uncertainty in the industry as to where the ultimate decisions lay; and this might possibly make accountability less rather than more secure. As Lord Reith said, when the proposal was put to him, 'For whom would the public corporation be working, putting it quite straightly?' And he indicated that a select committee which might start as a friendly communicative body might end by investigating and controlling.

The main argument advanced against the proposal was that it would impede the working of the nationalised industries and destroy initiative in them. Mr. Herbert Morrison said, 'The . . . point that I am apprehensive about is that it would create a rather un-nerving prospect for these ordinary business men who are running, in the main, the publicly-owned industries. It might un-nerve them and tend to develop in them a rather red-tapeish, unadventurous and conventionally civil service frame of mind, which is all right in the case of Government departments but is wrong in the case of public corporations, and that is why Parliament decided on public corporations in part.' Witnesses were apprehensive of a committee if its functions included enquiries into wide decisions of policy. Sir Geoffrey Heyworth, the Chairman of Unilever Ltd., and a part-time member of the Coal Board, was asked, 'Do you think that Parliament could possibly be better informed if the chairman and board of members were to meet a Committee of Parliament purely to answer questions on their annual report and accounts and on their policy?' He replied, 'Well, I can see some point in that. I do not believe it might work too well because I cannot help feeling you would have to ask them questions such as "Did that thing turn out as well as you thought it would?" and they would have to say no or yes, whichever was the truth. "What hopes have you got for this particular new idea you are now pursuing?" In this imperfect world things do not turn out as they should do, and then someone turns up next time and says you did not do so well with that.' Witnesses expressed themselves even more strongly over the possibility that the committee might investigate the detailed management of the industries. Lord Reith even spoke of it as a terrifying prospect.

Sir Geoffrey Heyworth said the great public corporations had not yet had time to settle down as integrated bodies, and that in due course they, like Unilever and other great commercial undertakings, would develop their own internal controls and their own adequate relationships with the outside public. A natural development of this was, as Sir Geoffrey said, 'The more you make this into autonomous units, I think the better chance there is for success.' He indicated that the process of integration in the case of the Coal Board, for instance, might take a very long time.

Determination of the Argument

The basic argument for the establishment of a committee to be a liaison between the nationalised industries and Parliament and elicit such information as is necessary on behalf of the House of Commons is that such a committee is the only practical means of performing these functions. Last session the Committee investigated the possibility of extending the sphere of the Parliamentary question, and reported that it was inadvisable. Apart from this the number of ways by which the House of Commons can, on its own initiative, obtain information is limited. There is debate, the various forms of which have been set out, but which has not fully satisfied members and sometimes has not occurred sufficiently frequently or sufficiently soon after the issue of reports; there is the procedure of moving for returns, which is not frequently used or altogether appropriate. There remains only the committee, a body appointed by the House to obtain information for it.

The report goes on to say that the Committee, therefore,

decided that it must either accept the objections and thus abandon all possibility of dealing with the present situation or, despite the difficulties, make—with due safeguards—provision for such an enlargement of the field of parliamentary accountability as would provide the House of Commons with the information which it rightly requires without, in obtaining that information, interfering with or jeopardising the efficiency of the nationalised industries. A Committee appears to be the most appropriate means by which this can be done. It is essential that the Committee which is recommended will, when appointed, set up a tradition of conduct which will result in its being regarded by the board not as an enemy, or a critic, but as a confidant, and a protection against irresponsible pressure, as well as a guardian of the public interest. In the Committee's opinion, the terms of reference of the proposed Committee can be so drafted as to avoid the graver of the objections alleged against it.

Nature and Work of the Committee

The question next considered was whether the proposed Committee should be a Committee of the House of Commons only, or a joint Committee of both Houses. The advantages of a joint Committee were urged by some of the witnesses, particularly Captain Crookshank and Lord Hurcomb. The arguments in favour of a Joint Committee, which appealed strongly to some members of the Select Committee, are that the House of Lords has a great number of members with business and executive experience available for the work; that in general the peers are less encumbered with the pressing distractions of everyday work; that the members of the Upper House are less dedicated to party allegiance; that their membership of their House would give the committee the element of continuity which it would need; and that if a Committee were appointed of one House alone, the other House might possibly set up another Committee with unfortunate results.

It was felt, however, that some of the work of the proposed committee must be of a financial nature, and would be more fittingly done by a Committee of the House of Commons. Nationalisation arose as an act of policy and, for certain industries and services, has been carried into law on the initiative of the representatives of the people in the House of Commons. It can be said that the general public are now the owners of the nationalised industries. It seems entirely appropriate, therefore, that any Parliamentary Committee set up to examine, and obtain information about, these industries at this stage of their development should be an exclusively House of Commons Committee. A tradition of public service could be built up in a Commons Committee not inferior to that of the Committee of Public Accounts. On balance therefore the Committee decided with some regrets against the proposal of a Joint Committee.

It then considered the nature and methods of work of the proposed Committee. In the first place, it should take over the right which the Committee of Public Accounts at present has to examine the accounts of the nationalised industries, and which that Committee is unable at present fully to exercise. The proposed new Committee should consider all the published accounts and auditors' reports of the public corporations, and make representations about such matters as seem to require consideration by the boards or debate in the House.

In examining this problem, the Committee confined its attention to nationalised industries which are conducted on a commercial basis, and whose annual receipts are derived from services rendered or the goods they supply. Other public corporations such as the new towns corporations do not appear to fall into this category and should be left within the field of responsibility of the Committee of Public Accounts.

In the second place, the Committee should be empowered to extend its enquiries more widely than those which the Committee of Public Accounts makes into the Government departments. It should have a regard, not merely to present and past financial probity and stability, but to future plans and programmes.

In the third place, it was considered that the Committee should have power to get information as to the policy of the corporations. It would have no need to investigate any decision which is the result of a direction from the responsible Minister, and for which he is accountable to Parliament. Again, any matters which are normally decided by collective bargaining arrangements should be avoided.

The Committee should, in the first instance, examine and deal with the chairmen and boards of the nationalised industries and the Select Committee hopes that the boards will come to regard the Committee, not as a criticising body but one which they can approach to explain their policies and their difficulties. The emphasis of the work of the Committee should be not only on finance but also on general lines of policy. In view of the overwhelming evidence received, it was felt strongly that the Committee should avoid the investigation of matters which fall into the category of detailed administration.

The Select Committee was impressed by the suggestion of Sir Frank Tribe that it would be of great value to the Committee if the great public corporations should be encouraged to prepare statements of their anticipated revenue and expenditure. This would enable it to satisfy itself that the corporation was genuinely trying to comply with its statutory requirements of breaking even, taking one year with another, and it would give it a means of comparing what had been expected at the beginning with the actual outturn. This suggestion is commended to the attention of the new Committee.

It is recognised that the proposed Committee may not have time each year to conduct a detailed examination of each of the nationalised industries. It is therefore suggested that for the information of Parliament as a whole, and having particular regard to the duty of the House of Commons to safeguard the interests of consumers, each corporation should publish with its annual report to Parliament the best estimate it can make of the percentage increase or decrease since the date of its establishment in the average cost to the consumer of its products or services, taken as a whole. This figure should accompany the annual accounts and reference to it should be included in the auditors' reports. This would enable the Committee to form some opinion, though not a conclusive one, on the efficiency of the industry, as it could be compared with the general cost of living index.

Although the range of the nationalised industries is too vast to be examined adequately by one Committee sitting as a single body, the Committee was advised by the leader of the House that it would be inexpedient, owing to the increasing calls upon members' available time, to set up more than one such Committee. It should have power to set up sub-committees.

Suggested Standing Order

It has been suggested that the proposed Committee should have the task of directing the debates which are held in the House on the nationalised industries, and of suggesting the allocation of time to each subject of debate. It is felt, however, that such direction of the work of the House might not appeal to the House and that it conflicts in some degree with the principle of free debate which has so far prevailed in the House of Commons. It is considered that the proposed Committee should determine its own programme and rate of progress.

The Standing Order under which the Committee would be set up should, in the Select Committee's opinion, run as follows:—

> 'There shall be a select committee, to be designated the Committee on Nationalised Industries, for examining the reports and accounts of, and for obtaining further information as to the general policy and practice of the nationalised industries established by statute whose controlling boards are wholly appointed by Ministers of the Crown and whose annual receipts are not wholly or mainly derived from moneys provided by Parliament or advanced from the Exchequer. The Committee shall consist of not more than 21 members, who shall be nominated at the commencement of every session and of whom seven shall be a quorum. The Committee shall have power to appoint sub-committees from its own members.

The Committee and any such sub-committee shall have power to send for persons, papers and records, and to report from time to time.'

The Permanent Officer

In considering a model for the organisation of the Committee, the Select Committee had in mind the Committee of Public Accounts, which has proved in the course of nearly a century an invaluable instrument of public service. That the Committee of Public Accounts should in the view of at least one witness have proved more successful than the Select Committee on Estimates is undoubtedly due to the work of the Comptroller and Auditor General and his staff, who are able to gain an intimate knowledge of the financial background and methods of the Government departments, and are able to digest this knowledge into the form of reports which are the basis of the work and the reports of the Committee of Public Accounts itself. It was clear that the proposed new Committee would need the assistance of a similar permanent official, to direct its attention to the important matters in the vast organisations which it is set up to consider. It was, however, realised that as the proposed Committee would have to deal more with contemporary and future matters than is the case of the work of the Committee of Public Accounts, the permanent official would have a different approach from the Comptroller and Auditor General.

The staff of the Comptroller and Auditor General work continually in the offices of the various public departments whose accounts they are auditing, and all the accounts of these departments are examined by his staff. In the case of the nationalised industries, a firm of professional auditors is appointed by the Minister to each board. The reports of those auditors follow the pattern of ordinary reports of commercial auditors. The nature of the accounts of the public departments, which are audited by the staff of the Comptroller and Auditor General, are in many respects different from those of the nationalised industries, which are commercial undertakings. The former are, in general, the subject of annual cash votes by Parliament, and Parliament therefore insists on the most detailed examination and control. The Comptroller and Auditor General exercises his functions in three ways: by detailed audit of departmental accounts; by reporting on ' questions of waste and extravagance '; and by ensuring, through his appropriation audit, that the moneys voted by Parliament are applied to the matters for which they have been voted. On these subjects he reports to Parliament, discusses his reports with the Chairman of the Committee of Public Accounts before the meetings of the Committee of Public Accounts, and he is present to give evidence upon them during the meetings. The accounts of the nationalised industries are, on the other hand, only the reflection of the results of the year's trading. They are presented in the usual commercial form of trading accounts, profit and loss accounts, and balance sheets. These accounts are certified as correct by the firms of professional auditors appointed by the Minister.

A Professional Accountant's Job

The President of the Institute of Chartered Accountants in a memorandum and in evidence suggested that part of the functions which the Comptroller and Auditor General discharges in respect of the Government departments could here be discharged by a professional accountant, who could study the voluminous accounts published by the nationalised industries and pick out the matters to which the Committee should direct attention. He also suggested that the statutory auditors of the nationalised industries might make an extension of their normal duties and include a supplementary report in which they could draw attention to ' any matter of a material or substantial character which may have arisen ' under various headings. These might include failure to comply with directives of Ministers, efforts to ensure that revenue was not less than revenue outgoings, whether Government grants or subsidies had been given on the basis of estimates subsequently found to be unsound, whether accounts showed fairly and clearly results of operations, and whether the auditor was of the opinion that there was a *prima facie* case for further investigation into lack of proper control of revenue and expenditure, capital expenditure which had not proved productive, and wasteful expenditure.

Among other witnesses, Sir Edward Bridges agreed that a certain extension of the field of the auditors' reports might be desirable. He suggested that the notes which are appended to the accounts might be extended to cover a wider account of the financial background of the board on which they are reporting, and to deal with broad policy issues with which the boards are concerned. If this suggestion could be adopted it would be useful. On the other hand, the Select Committee is not convinced that the statutory auditors could or should be asked to fulfil the rôle of the Comptroller and Auditor General for the new Committee. The duties of the statutory auditor are those of normal commercial auditors, and it is essential, for the sake of preserving their good relations with the corporations whose accounts they audit that their approach to those accounts should not differ too widely from those of ordinary professional auditors.

It was suggested in the course of the evidence that the present Comptroller and Auditor General might himself perform the work on the nationalised industries which he now performs on the Government departments. Sir Frank Tribe agreed that this could be done, but he warned that it would entail an enormous expansion of his organisation and a complete dislocation of the auditing profession in this country.

Servant of the House

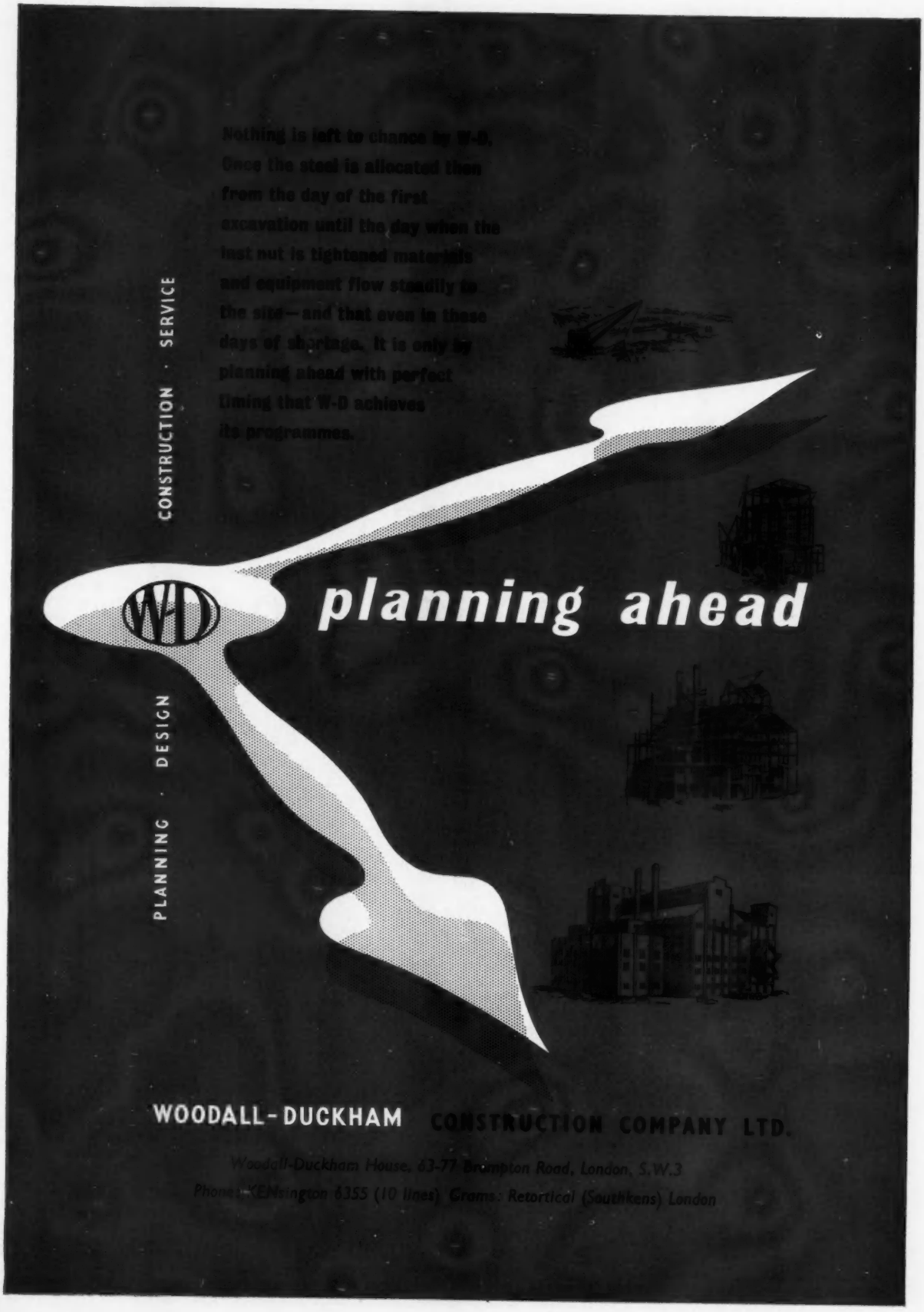
It was also suggested that the permanent officer of the Committee should be an officer from a central department of State, perhaps the Treasury. After consideration, however, it was felt that the permanent officer of the Committee, once appointed, should be a servant of the House of Commons, and not of the Government or of any of the corporations, and not removable except by an address from each House of Parliament.

The Select Committee came to the conclusion that the staff of the proposed committee should be as follows: There would necessarily be a Clerk to the Committee supplied from the staff of the Clerk of the House in the normal way. Then there would be a permanent official of a status roughly equivalent to that of the Comptroller and Auditor General or the Speaker's Counsel. He would work with the assistance of at least one professional accountant, and such other staff as the Committee might deem useful, and would examine the reports and accounts of the nationalised industries in order to direct the Committee's attention to matters requiring examination. If the Committee so desired, the Minister in charge of the department responsible for the general oversight of the industry whose affairs were under review should be invited to send a senior official to assist the Committee in the examination of evidence.

FUEL EFFICIENCY IN SCOTLAND

AN assurance has been given to the Scottish Fuel Efficiency Committee by Sir John Maud, Permanent Secretary to the Ministry of Fuel and Power, that after the committee's duties have been taken over by a Government-sponsored organisation, the committee will continue to function for some time to advise the new organisation on fuel efficiency services in Scotland. This was announced in Glasgow by Sir Patrick Dollan, Chairman of the committee, when he outlined some details of the change-over.

Sir Patrick said he expected that his committee would continue to function until early 1954. The new organisation, which would be directed by the British Productivity Council, would receive an annual subsidy of £450,000—£250,000 from the National Coal Board, and £100,000 from both the British Electricity Authority and the Gas Council. In addition, it was hoped that donations would be received from companies and firms, and fees would be charged against companies for special efficiency services when requested.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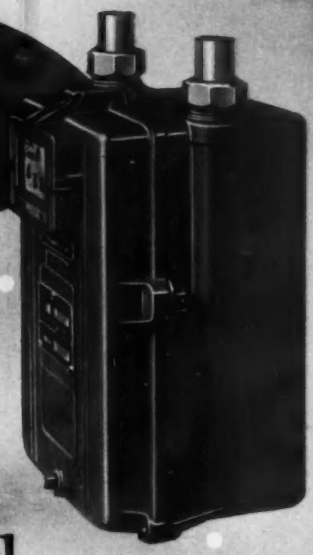

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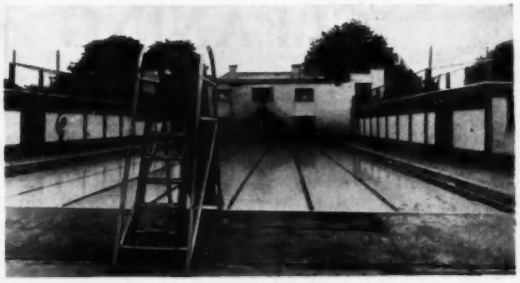
Open-Air Swimming Pool at Spalding

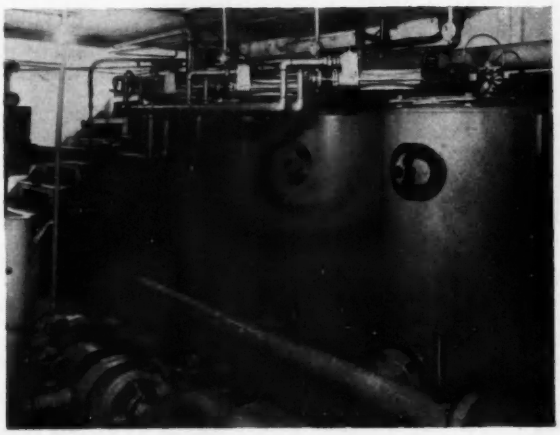


A view of the pool looking towards the deep end.

Water Heating by Gas

THE water heating and purification plant of the Spalding Urban District Council swimming pool is the subject of a report (No. 521/52) of the Gas Council Industrial Development Committee, the information being supplied by the East Midlands Gas Board. The gas-fired boiler was installed by the Spalding undertaking of the Board, and the water purification plant by Bell Bros. (Manchester 1927) Ltd. The installation was completed in the summer of 1950. The capacity of the pool is 120,000 gal., and the purification plant is designed to filter, purify, and recondition the whole of this quantity of water in eight hours, which is equivalent to a rate of 15,000 gal. per hour.

The process of water purification is a constant cycle. From the deep end of the swimming pool, the water is drawn through a grating by an electrically operated pump, and to prevent solid matter passing forward to the pump a strainer is fitted which is readily accessible for inspection and cleaning. Measured quantities of sulphate of alumina are added to the water prior to passing to the filter. The alumina is added to assist the filtering medium in extracting all suspended matter. The chemical apparatus consists of a tank in which the alumina is automatically supplied and mixed. A special pump is provided for pumping the solution into the main and into the filter bed at a constant rate. The apparatus is provided with adjustable mechanism so that the quantities of solution added to the water may be altered to suit varying bathing loads. The filtering medium is a special coarse sand suitably arranged to give good filtering without excessive pressure losses.



View of the three sections of the gas-fired boiler.

After filtration the water is heated by passing through a 'Vesta' gas-fired boiler. The water is passed through an aerator to be oxygenised and de-odorised, and then measured quantities of either sodium carbonate or sodium bicarbonate are added to the water for neutralising the acidity caused by the alumina. Finally, the water is sterilised with chlorine gas and then returned to the swimming pool at the shallow end in a warm, crystal-clear, and sterile condition.

During the normal process of filtering the water enters at the top of the filter and flows downwards through the bed of sand to the outlet at the bottom. Periodically, the filter requires washing by means of a reverse flow of water and the additional agitation of the bed by compressed air. The circulating pump is used for providing the reverse flow of water merely by manipulation of sluice valves provided on the filter, and the compressed air is supplied by a specially designed compressor of the water-lubricated type fitted adjacent to the filter. The operation takes between 20 and 30 minutes, and water passing through the filter is drained to waste.

In public swimming pools it is normal to find that a fine sediment, almost in the form of a dust, collects on the floor of the pool. Provision is made therefore to remove this accumulation of solid matter by connecting flexible hose to two suction sweepers fitted on one side of the pool. By this means, the whole of the floor of the pool is cleaned, and the sediment is collected at the strainer on the inlet to the circulating pump.

The gas-fired boiler is by Autocontrol Boilers, Ltd., and the rated output is 750,000 B.Th.U. per hour. The waste gases are vented by means of a centrifugal type fan, having a cast iron body and aluminium alloy impellor.

The average thermal efficiency guaranteed by the makers was 75% but this figure was not obtained when the plant was first put into operation. The results at this stage are shown in Test 1. Investigations made by boiler makers and the gas undertaking showed that the rate of water flow varied considerably from one section to another, also that the efficiency of each section was different. Therefore, the water flow to each unit was balanced and further adjustments were made to the gas and air controls. The final results are shown in Test 2.

Details		Test 1 (Initial adjustment)	Test 2 (Final adjustment)
Duration of test:	Hours	2	1
Average rise in temperature of water flowing through boiler, °F.		3.8	3.8
Rate of water flow, gal. per hour		13,800	14,100
Gas rate, cu. ft. per hour		1,750	1,520
Heat input per hour (460 C.V.), B.Th.U.		805,000	699,200
Thermal efficiency, %		65	77

Northern Juniors Visit Clarke Chapman

MEMBERS of the Northern Junior Gas Association, led by their President, Mr. T. R. Wicks, spent an interesting afternoon on July 22 visiting the works of Clarke Chapman & Co., Ltd., Gateshead.

Although recognised as the world's largest manufacturers of ships deck machinery, the firm has also a very high reputation for a variety of other engineering specialities, which include water-tube boilers, pulverising plant, pumping machinery, generating plant, and dry ash conveyors.

In the design and manufacture of water-tube boilers, the firm has over 50 years experience, in which time it has installed power-plants in many parts of the world. In this country many of the large B.E.A. generating stations are equipped with Clarke Chapman boilers and ancillary equipment. The gas industry is also served by this enterprising firm —a notable contract entrusted to it being for the supply and erection of a complete boiler plant at the Redheugh works of the Northern Gas Board. This included two boiler units, fuel and ash-handling plants, together with all ancillary equipment.

After completing their tour of the works the party was entertained at tea in the canteen. A welcome was extended to the visitors by Mr. J. B. Woodeson, Managing Director, Clarke Chapman & Co., Ltd. Mr. T. R. Wicks, President, on behalf of the Northern Juniors, moved a vote of thanks to Mr. Woodeson and his co-directors and staff for their hospitality.

THE second National Factory Equipment Exhibition will be held at the Royal Horticultural Society Halls, Westminster, from March 22 to 26, 1954. Four-fifths of the available space has already been sold. The exhibition organiser is Mr. J. E. Holdsworth, 117, Kingsway, London, W.C.2.

CLEANING OF GAS MAINS

PAPER TO THE MANCHESTER AND DISTRICT JUNIOR ASSOCIATION OF GAS ENGINEERS

by ***DONALD G. WILKINSON,***
District Distributing Engineer, Liverpool Group, North Western Gas Board.

IN recent years the presence of internal corrosion in our gas mains network has been more forcibly brought to our attention because of the increasing age of the mains system. Mains relay programmes have not been operated to anything like the extent that they would have been under pre-war conditions. Corrosion builds up inside the pipes and causes considerable reduction in the carrying relays, the question of internal cleanings of all mains which have a satisfactory wall structure should receive the consideration of the distributing engineer. In many cases that have been examined, the mechanical strength and general condition of the walls of the mains are excellent, though the presence of this voluminous corrosion has called for action. A method of removing this internal corrosion has been evolved and is outlined in what follows.

(i) The most reliable way of finding which mains should be cleaned is by visual inspection and this is possible when a main is cut out or when connections are made during normal service relay work. Service layers are encouraged to draw the attention of the district engineer to these conditions and provision is made on the back of the job card for such reports.

(ii) When the supply to a premises is poor even after relay of the service, it is evidence of a partial stoppage at some point remote from the relay.

In both cases a pressure survey should be made, and, taking into account the load on the mains, the survey will show up the mains which require attention.

Technique of Cleaning

Following the pressure surveys, a plan of operation must be formed, and this is yet another occasion when accurate records of the positions of the mains are invaluable. The general practice is ' to bring the gas with you '—*i.e.*, a start is made on the mains teed directly off the largest clean main already carrying a satisfactory pressure. All premises fed by the section of main chosen for cleaning are without gas while the cleaning is in progress except in the case of factories, hospitals, etc., when a temporary supply may be arranged. It is desirable for a maintenance fitter to be on the job for contact with the consumer. He is responsible for the following:—

He must warn all consumers supplied by the section that they will be without gas for a period of four to six hours. This warning must be given at least the previous day. Access should be gained to all premises, but if unobtainable, the fitter must leave a notice warning the consumer to make arrangements so that he can gain admission on the day of cleaning in order to turn off the main tap. If no contact with the consumer has been made, the service is cut off outside and before the service is reconnected. This necessitates a further notice to the effect that service will be reconnected only when the gas undertaking is requested by the consumer, who at the same time specifies when the premises will be open. Of course, the fitter must turn off all main taps on inlet to meters so that when the main is reconnected no premises will be liable to escape of gas. He turns on all the main taps after the main has been reconnected and purges the fittings on the premises, at the same time regulating the various appliances to the increased pressure.

When the main is isolated, screw buffers are fitted in all the open ends, main taps are turned off, and the main is air-tested. The internal pressure is raised to 12 in. W.G. and the pressure drop over a minute is noted. There is almost certain to be a slight fall in pressure due to pilot lights on lamps which cannot be turned off, faulty main taps, and slight leakage on services and main. After cleaning, the main is again tested to a pressure of 12 in. and the pressure drop over a minute noted.

Isolating the Section

As water is the carrier for the corrosion, when selecting the section for cleaning, the contour of the main must be kept in mind. It is the practice to cut out syphons, as these are the low points, and to rod both ways, against the flow of water. The length of the section is therefore determined by local conditions—the length to the next tee, the contour of the ground, the position of the next syphon, etc. These will determine where the next cut will be made and where the water will be introduced. The section must be completely isolated, any mains teed-off being cut off, and the ends sealed with screw buffers. Should the section be teed-off a main which has already been cleaned, the portion from the clean main to the first excavation in the section is ' alive ' and is ' dry back rodded,' the rods and cleaning head being spun in against gas pressure and the corrosion blown out as it is agitated. This operation is done with all the precautions required when working with ' live ' gas.

Corrosion is loosened by a rotating head. The heads used are of various types—brushes, rigid blade scrapers, or flails, the latter being formed by a head considerably smaller in diameter than the bore of the main and to which is attached a number of chains having case-hardened balls of metal at their free ends. Centrifugal action throws the balls out and as the rods are fed down the main, they thrash their way through the corrosion. The head is connected, either by thread or quick release coupling, to flexible rods, which may be either solid nickel steel in 15 ft. lengths or laminated steel rods, metal bound in 3 to 15 ft. lengths.

The rods are rotated by either petrol engine complete with clutch and gear box at 250-1,000 *r.p.m.* or by compressed air drive at approximately 400 *r.p.m.* The head is fed into the section by adding rods at the end near the drive. The petrol engine and 15 ft. rods are used for lengths of main up to 350 yards and the air drive and 3 ft. rods for lengths up to 100 yards.

When the preparatory work has been completed, the water is turned on slowly and allowed to percolate through the corrosion to the rodding end, when the pump is started up and the discharges are arranged to deliver into a large barrel or drum, acting as a settling tank. Rodding is then started, The rods are fed in at a slow walking pace and their progress can be easily detected by ear, although a count of the number of rods inside the main is carefully kept. When the head has travelled the full length, the rods are pulled out still rotating in the same direction. As would be expected, the water flow can then be increased and a flushing action takes place which leaves the inner walls of the main clean and smooth.

The water is turned off and the section allowed to drain. This often takes some time and occasionally reveals main subsidence with the consequent lodging of water in the main. For this reason it is necessary to follow up with a final pressure survey after main is cleaned.

Costs

At Southport 59.9 miles of 3-in. 4-in., and 6-in. mains were cleaned at an average cost of 6s. 11d. per yard exclusive of reinstatement but inclusive of all labour and material overheads. The ground at Southport is sand and most of the mains are in the footwalk. Lengths up to 400 yards were cleaned in one operation. Estimated cost of reinstatement for this area was 6d. per yard of main cleaned.

Where the mains are laid under the carriageway in a densely populated area with a large number of tee connections, thus limiting the maximum length for one operation to approximately 200 yards, the costs of cleaning are considerably higher, the average cost per yard (exclusive of reinstatement) being 10s. 10d. Cost of reinstatement may be as high as 1s. 6d. per yard of main cleaned. The average cost to relay the mains (inclusive of reinstatement) would be £2 12s. 6d. per yard.

Recently 1,117 yards of a 12-in. low pressure district main, with numerous side connections and laid in a busy arterial road, was cleaned, the cost for the job averaging £1 4s. 9d. a yard (exclusive of reinstatement). Cost of reinstatement was about 1s. 6d. per yard. The average cost of relaying this main inclusive of reinstatement) would be in the order of £5 per yard.

Extensive experience over several years using the methods described shows that the internal cleaning of mains is a satisfactory and practical way of restoring them to their full carrying capacity. The results obtained when comparisons are made between the initial and final pressure surveys are of immense satisfaction to workmen and staff alike. From the consumer's point of view, the results obtained in a time as short as four to six hours, during which the supply has changed from unsatisfactory to perfect, naturally give immense satisfaction. This rapid change in gas supply conditions impresses consumers and gives an impetus to our mains personnel.

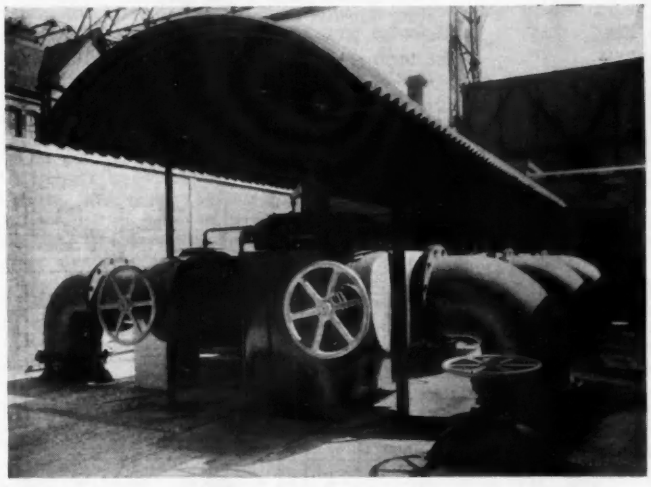
Open Governor Installation

IT was recently found necessary to install three new station governors at the Birkenhead works of the North Western Gas Board. Normal practice in the gas industry has been to install station governors in substantially built brick buildings, but due to the increased cost of building work it was decided not to install these governors in the usual way. In making this decision, it was realised that the most likely ill effect from leaving governors in the open would be the freezing of the governor valves, but this can be avoided, as described later. The installation consists of three 24 in. dia. Bryan Donkin diaphragm type station governors with gas loading controlled by a system of auxiliary governors. The main governors and valves are situated in an open compound, but an 'umbrella' cover about 10 ft. wide has been erected over the three governors to give protection from snow and rain. This consists of curved bitumen protected corrugated steel sheets (Robertson's protected metal) supported by a light angle iron framework. The sheets are removable for maintenance purposes. At one end of the compound there is a building, 15 ft. by 10 ft., in which are situated the auxiliary gear for the control of the governors, and the pressure indicating and recording instruments accommodated on a suitable instrument panel. The panel is divided into four sections, one section for each of the three governors, comprising a pressure indicator, recorder, and the dial for adjusting the governor outlet pressure; the fourth section contains the indicator and recorder for the inlet pressure. A toe space is allowed at the bottom to prevent damage to the panel. The control pipes pass into the instrument room through covered ducts. The instruments are by Bristol's Instrument Co., Ltd., and the panel was made in the Birkenhead undertaking's own workshops.

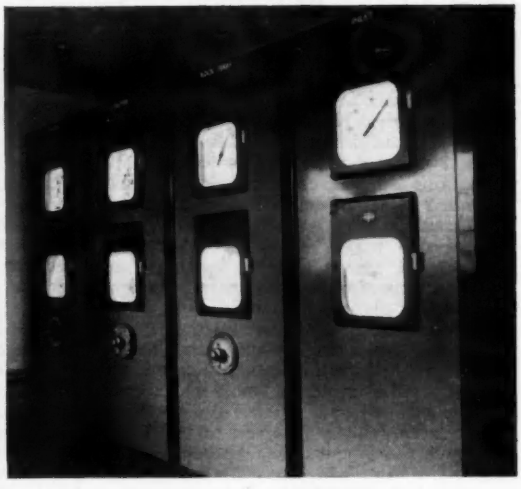
All the governors, isolating valves, and by-pass valves are fixed above ground at a convenient height for easy maintenance. The three outlets have been interconnected with two 24 in. diameter valves to enable any governor to be shut down for maintenance.

The governor compound is surrounded by a 9 ft. high wall built of 'Dri-Crete' precast concrete blocks which are interlocking and laid dry with the exception of two 'band' courses. This type of construction is cheaper than brick, but is more durable and gives better protection from dust than a fence.

To prevent freezing up of the governor valves, a steam heater has been fitted under each governor. A sheet metal casing has been provided to enclose the heater and the lower portion of the governor body. Air enters at the bottom of the casing and is warmed by the steam heater. The warm air then passes upwards between the casing and the governor body, and spills out below the main diaphragm. Thermometers are to be provided to keep a record of the inlet and outlet temperatures on this prototype installation, so as to check the effect of the heaters. However, on an installation of this size in an industrial district it is probable that there will always be a sufficient flow of gas to prevent freezing.



View inside compound. The casing for the heating unit can be seen on the first governor.



Instrument and control panel inside the instrument room.

A metal cover has been designed and fitted to protect the roller guides for the main spindle at the top of the governor, and experiments are being carried out to provide protection for the governor spindle from dust and grit in the form of an expanding rubber sleeve. If this is successful, the most important moving part on the outside of the governor will be more efficiently protected than is the usual case when the governors are inside a building.

The advantages of the arrangement are as follows:—

(1) Considerable saving in capital cost as compared with governors housed in a building. The instrument room and building work on the compound cost £1,954 compared with an estimated cost of £4,000 for a traditional building with plastered walls, concrete lintels and coping stones and a tiled floor, or £3,000 for an austerity building having the brick walls painted and concrete floor.
(2) Ease of maintenance.
(3) Safety during maintenance work. There is no possibility of a concentration of gas, or an explosive mixture.
(4) Saving of building materials and steel.

INTERMITTENT SPACE HEATING

PAPER TO THE LONDON AND SOUTHERN JUNIOR GAS ASSOCIATION BY

D. R. WILLS

B.Sc., A.C.G.I., A.M.I.Mech.E., M.Inst.Gas E., North Thames Gas Board, Watson House

THE subject of space heating is one of absorbing interest and of some complexity. The aim of this paper is to examine some of the many problems associated with the heating of various types of buildings. The heating technician is always faced with the primary question of how much heat is required in particular circumstances to produce defined temperature conditions in a particular room or building, having regard to the type of heating he intends to use. Basic calculations are made using the conventional assumption that the steady thermal state applies. Empirical margins or additions to this basic figure are sometimes made, depending on the type of heating and the conditions of use. Often they are ignored altogether and in very many cases there is a great deal of uncertainty as to the size of the addition and the ultimate efficacy of the heating system based on such calculations. The analysis which follows may show that there is no simple answer to the primary question of—'How much heat?'

The term 'continuous heating' is widely used to describe methods of heating which are in no way continuous and at no time is the steady state, implying thermal equilibrium, reached. Continuous heating is more the exception than the rule. Nearly all space heating is intermittent in character and is either 'periodic' or 'transient.' The former description is applied to cases where the premises are more or less continuously occupied, but there are repeated cycles of temperature variation, each daily cycle being similar to the one immediately preceding it and to the one which follows. 'Transient' heating, on the other hand, means that the heating is required for short periods, separated by comparatively long periods when the heating plant is shut off.

In domestic heating we are much more concerned with the heating of a single room rather than the whole house. Whole house heating has a limited application in this country and even where whole house heating systems have been installed they operate on a periodic cycle and in most cases priority is given to the living room; in fact, although the systems may be capable of providing whole house heating, they do not do so. In the interests of fuel economy, whole house heating is a name rather than a practice.

Calculation of Heat Requirements

In computing the heat losses from a single room using the conventional method the simple basic calculation is of the form:—

$H = A_e U_e\ (t_i - t_o) + KV\ (t_i - t_o)$ where H = hourly heat loss.

A_e is an equivalent area representing walls, ceiling, etc.

U_e is an equivalent heat transmission coefficient.

$(t_i - t_o)$ is temperature difference between inside and outside temperature.

K is a constant.

V is the ventilation rate.

Reducing it to a fundamental form:—

$$H = (UA + KV)\ dt$$

where U involves only the conductivity of the building materials.

Only where thermal equilibrium is reached is the above form of equation strictly applicable.

In the heating of a room the desired temperature must first be reached, as the initial temperature is always lower than that necessary to provide reasonable comfort. The thermal storage capacity of the heavier parts of the structure must be satisfied, which means that the surrounding walls, floors, ceiling, etc., must be raised in temperature before a steady state can be reached. This takes several hours; in fact, in a normal sort of room the steady state is not reached until about 14 to 16 hours after the commencement of the heating.

Only for the lighter parts of the structure and the ventilation air, can the simple expression above be applied, while for the more massive parts of the structure, which for the normal period of domestic heating are the walls and floor and, for the early part of the cycle, the ceiling, the well-known Fourier equation applies:—

$$\frac{dt}{dT} = \frac{K}{sd}\,\frac{d^2t}{dx^2}$$

where t refers to temperature

T refers to time

x refers to the linear distance of the element from a boundary surface

K is the thermal conductivity of the material

s is the specific heat of the material

d is the density.

The term $\frac{K}{sd}$ is called 'the thermal diffusivity.'

The equation truly represents the heating process in the periodic part of any heating cycle or for single heating periods.

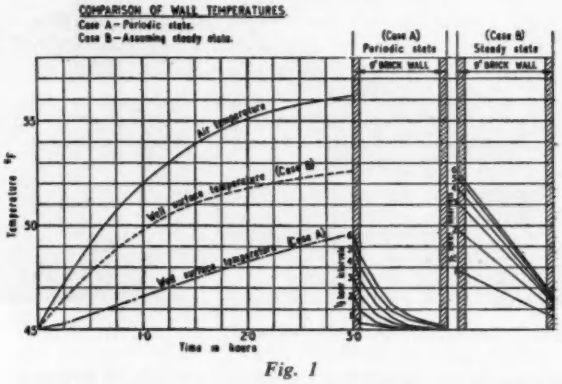


Fig. 1

Fig. 1 shows a heating-up curve obtained from temperature measurements in a room 12 ft. × 13 ft. 6 in. × 8 ft. high. This curve is typical of a normal single heating period for a living room. Two conditions for the wall temperature distribution are shown—Case A, referring to the periodic state and representing more truly the conditions, and Case B, assuming that at the end of each half-hour period the steady state had been reached as would be the case for a wall of zero thermal capacity; it would be nearly true for very thin, light structures. The differences are quite appreciable and it can be seen that it would take a long time for the steady state to be reached, as indicated by the converging of the two wall surface temperature curves.

To plot the curves, it is assumed that the air and wall temperatures are the same at the commencement of the heating period. This assumption is valid as it has been shown by Bruckmayer(1) that, for houses of solid construction, the overnight cooling of the house is about equal to that of the outside wall. It has also been assumed that the outside temperature is 45°F.

The analysis refers to heating by convection in the absence of any form of radiation, the presence of which introduces a further factor to be discussed later.

From the air temperature and wall surface temperature

curves the heat flow to the wall is calculable from:—

$H_w = A_w\ h_f\ (t_a - t_w)$

Where h_f is the surface film coefficient

t_a and t_w the air and wall temperatures at any particular time.

Table I compares the hourly heat flow rates for (*a*) periodic state, and (*b*) steady state:—

TABLE I.—THE HEATING OF A 9-IN. BRICK EXTERNAL WALL

Comparison of Periodic and Steady state

Time, hours	0		1		2		3	
State	(*a*) Periodic	(*b*) Steady	(*a*) Periodic	(*b*) Steady	(*a*) Periodic	(*b*) Steady	(*a*) Periodic	(*b*) Steady
Air temperature *ta* ..	45	45	52	52	55	55	56	56
Wall surface temperature *tw*	45	45	46.5	49.7	48.2	51.8	49.5	52.5
(*ta*—*tw*)	0	0	5.5	2.3	6.8	3.2	6.5	3.5
Heat flow rate, B.Th.U. per sq. ft. per hour ..	0	0	7.8	3.30	9.7	4.5	9.2	5.0
Ratio heat flow rate Col. *a* / Col. *b*	—	—	2.36		2.15		1.84	

Similar comparisons would be obtained for the floor, ceiling, and internal walls, although the two latter structural components would reach a steady state more quickly. It is quite obvious that, even ignoring the internal thermal storage in the form of furniture draperies, floor coverings, etc., the actual heat requirement is appreciably more than that given by the conventional calculation.

Comparison of Convective and Radiant Heating

In the following comparison the radiant heating is supplied by a convector gas fire standing in the hearth. The actual air temperature curve was deduced from a series of curves using a convector gas fire to warm the room, and, using this curve, it is possible to calculate the difference in heat input necessary to achieve the particular air temperature characteristic, using either all convective heating or mainly radiant heating. It is clear that the two methods of heating the room are quite different. With convection, the air is heated directly and heat passes from the air into the surrounding surfaces and the solid objects in the room. The temperature of such objects and surrounding surfaces will be lower than the air temperature.

Radiant heat passes directly into the objects and surrounding surfaces without appreciable absorption by the atmosphere. Theoretically the wall surfaces, etc., will always be warmer than the air, but this in practice will depend on the amount of absorption of the radiant heat by furniture, etc., compared with the walls, the air being heated by transfer of heat by convection from the furniture. The absorption of radiant heat directly by the water vapour in the atmosphere also makes a small contribution to the air heating.

The amount of heat passing into the surrounding surfaces by radiation can be allowed for by use of a concept known as the 'equivalent convective temperature' related to the air temperature, as follows:—

$$H = h_f\ (t_a - t_w) + eI$$

where H = total heat flow in B.Th.U. per hour per sq. ft.

h_f = surface film coefficient

t_a = air temperature

t_w = wall surface temperature

e = emissivity of wall material

I = radiant intensity on wall surface.

The heat flow can be written as:—

$H = h_f\ (t_e - t_w)$ where t_e is the 'equivalent convective temperature,' thus treating all the heat as convective heat.

It follows that:—

$$h_f\ (t_e - t_w) = h_f(t_a - t_w) + eI \text{ and}$$

$$t_e = t_a + \frac{eI}{h_f}$$

This new temperature concept can be used to estimate the increase in wall temperature due to the incident radiant heat and can also be used to calculate the transmission losses through or into the structure. The heat carried away by the ventilating air is of course calculated from the air temperature.

Fig. 2 gives comparative curves for the two methods of heating and also illustrates the effect of lining the walls with an insulating material having a fairly low thermal capacity.

The curves are based on the following conditions:—

(1) The heating period is three hours.

(2) The air temperature rise remains the same in each case.

(3) The two methods of heating employed are assumed to be either:—

(*a*) by convection only, or

(*b*) with radiation from a convector gas fire included.

The wall temperatures are calculated by using the method of finite differences employing a graphical method(2). Comparisons have been made between calculated and measured wall temperatures in a series of transient heating tests(3) and reasonable agreement was found between the calculated and measured values.

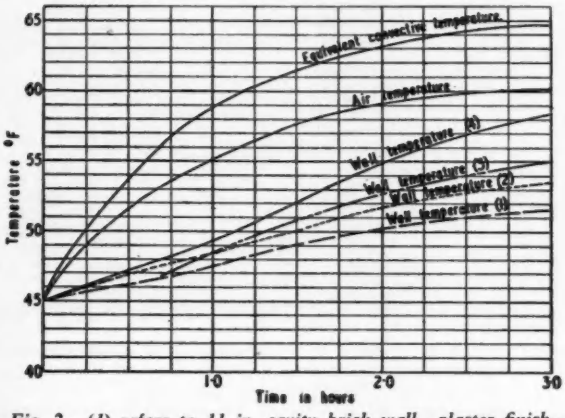


Fig. 2.—(1) refers to 11 in. cavity brick wall—plaster finish—convective heating only; (2) refers to 11 in. cavity brick wall—plaster finish with radiant heat included; (3) refers to same wall with 1 in. wood wool inner lining added—convection only; (4) refers to condition (3) with radiant heat included.

Comparison of wall temperature curves (1) and (2) shows the effect of radiant heat in promoting a quicker warming of the wall surfaces. This is important to thermal comfort. The second curve is calculated from the equivalent convective temperature, thus allowing for the radiant heat.

Wall temperature curve (3) illustrates the effect of an inner lining. The higher wall surface temperature obtained makes an important contribution to thermal comfort particularly in the case of short period heating. Over a longer period, when the heat has penetrated the base material, although the effect of the low thermal capacity in promoting rapid rise of wall surface temperature is less marked, the surface temperature will still remain higher than if the lining were absent. This clearly results in, not only a higher comfort level during the early stages of heating, but a higher average for the whole period. This is indicated by experimental work by Dufton(4) on the warming of a panelled and unpanelled room, comfort being attained in half an hour in the first case, compared with one and a half hours in the second in the particular circumstances of the experiment. For more detailed treatments of this important subject reference should be made to papers by J. C. Weston and A. W. Pratt(5) and by M. V. Griffiths(6).

When the heating of a room is by means of a source of high temperature radiant heat, the influence of linings of low thermal capacity may be less marked, but it has been demonstrated by Yarnold(7) using a double eupatheoscope, that thermal comfort depends on back conditions as well as the radiant heat received directly from a unidirectional source of radiant heat. It surely follows that the higher the temperature of the surrounding wall surfaces the more likely it is that comfort will be attained,

even though the over-riding influence is the radiant heat from the fire.

An extremely important factor often overlooked in room heating is the floor temperature. It has been considered that radiant heat received by the floor cannot be regarded as very useful, as the ventilation loss is increased by the heating up of the air flowing across the floor to the fire and thence into the flue. If this is so, the useful room heating efficiency might be reduced, but the author suggests that the higher floor temperature resulting from the radiant heat falling on the floor, by the resulting reduction in temperature gradient in the room and the raising of the M.R.T. near the occupants' lower extremities, introduces advantages which far outweigh other considerations.

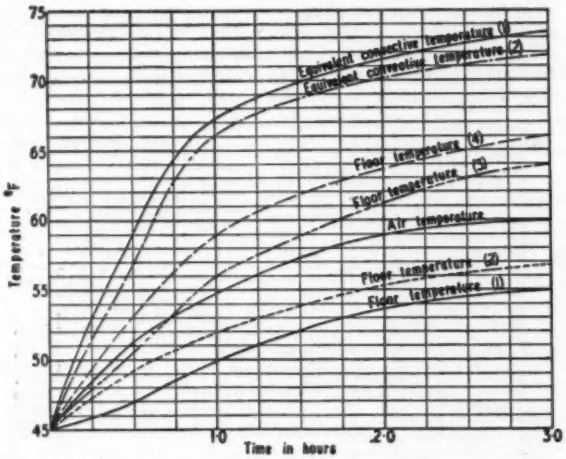


Fig. 3.—Equivalent convective temperature: (1) For wood block on concrete floor; (2) with carpet. Floor temperature curves: (1) Uncarpeted floor—convective heating only; (2) carpeted floor—convective heating only; (3) uncarpeted floor—radiant heat added; (4) carpeted floor—radiant heat added.

For the room in question, floor temperatures are compared in Fig 3. The air temperature rise is the same as that shown on Fig. 2, whilst the 'equivalent convective temperature curves' were calculated from an analysis of the radiant heat received by the floor.

Floor temperature curves (1) and (2) refer to heating by convection only, ignoring the effect of temperature gradient which, if included, would give even lower floor temperatures for the same mean air temperature than indicated by the curves. The effect of the floor covering is clearly illustrated.

The upper curves (3) and (4) are the floor surface temperatures resulting when the radiant heat is included. Considering the case of the carpeted floor at the end of three hours, Table II gives the comparative temperatures, the figures referring to an unfurnished room.

TABLE II.—Air, Wall, and Floor Surface Temperatures

	Convective Heating only	With Radiant Heat included
(1) Air temperature	60° F.	60° F.
(2) Wall surface temperature, insulated wall	55° F.	58.5° F.
(3) Floor surface temperature, carpeted floor	56.8° F.	66° F.

The comparisons indicate that, quite apart from the direct effect of the radiant heat, the comfort temperature, which depends on both air temperature and the temperature of the surrounding surfaces, is markedly higher when a source of high temperature radiant heat is present.

Estimated Heat Requirements for Whole Room

The room to which the following comparisons refer is 13 ft. 6 in. × 12 ft. × 8 ft. and has external walls of 11 in. cavity brick with an inner lining of 1-in. wood wool and is plastered. The floor is wood blocks on concrete, uncarpeted. The partition wall is 4½-in. breeze block.

It is assumed that the outside temperature is 30°F. and the overnight cooling has resulted in the outer walls and air temperature being both at 45°F. at the commencement of the heating period, which assumptions are reasonably consistent with practice. The figures refer to the end of the heating period of three hours, when the air temperature has reached 60°F. Further assumptions are that the ceiling, the lighter breeze walls, the door, and the widow, reach the steady state quickly. This assumption will give an underestimate of the heat absorbed by these components during periodic heating. The ventilation rate is two air changes per hour and heating is by a convector gas fire. Table III gives the comparisons.

TABLE III.—Comparison of Estimated Heat Requirements

Condition	Length of heating period	Temperature rise above outside	Heat requirement B.Th.U. per hour	Heat requirement Ratio—Steady state value
Assuming steady state	3	30° F.	6,300	1.0
Periodic heating convection only	3	30° F.	7,600	1.21
Periodic heating radiation added	3	30° F.	10,500	1.67

These comparisons refer to an empty room and the actual ratios to the assumed conditions which, however, are reasonably related to practice. The values for periodic heating are more likely to be conservative than liberal. The important point is that, if the air temperature only is the overriding consideration, the use of a radiant source of heat in the form of a gas fire will entail a heat input perhaps 35 to 40% greater than with heating entirely by convection. It has been shown already, however, that the temperature of the floor and walls is appreciably greater when radiant heat is used. This fact, together with direct effects of the radiant heat, would ensure a much higher comfort temperature than with convective heating, and such factors cannot be ignored; they are discussed later.

The other important aspect of the comparison is that periodic heating, even with a preheating period of three hours, demands a fairly substantial margin over the steady state heat requirement. With longer preheating periods the margin becomes less, but the preheating period would have to be of the order of 12 hours before the steady state is actually reached.

There have been a number of recommendations in various publications for the differentiation between mainly convective and high temperature radiation, some of which have suggested that a 5°F. difference in temperature is allowable when radiant heat is present—in other words, an air temperature of 60°F., when high temperature radiation is present, shall be deemed equivalent to 65°F. for convection heating.

Values have been estimated for conditions similar to the previous example, except that the temperature attained in three hours is 65°F. and the heating is by convection.

The temperatures reached are as follows:—

Initial temperature of air and surroundings	45°F.
Final air temperature	65°F.
Wall temperature—brick plaster finish	54°F.
Wall temperature—1-in. wood wool insulation	58°F.
Floor temperature—uncarpeted	58°F.
Floor temperature—carpet surface	60.5°F.

These surface temperatures should be compared with the 60°F. air temperature conditions with a radiant source of heat present; the difference in floor temperature is quite apparent.

The heat requirements to attain 65°F. air temperature in three hours are:—

Calculated for periodic state 9,100 B.Th.U. per hour
Assuming steady state conditions 7,690 B.Th.U. per hour

$$\text{Ratio } \frac{\text{Periodic state}}{\text{Steady state}} = 1.19$$

A more detailed discussion on comfort conditions occurs later, but it is possible that the comfort level, quite apart from the direct effects of the radiant heat, would not be as good in the case above compared with the previous example, on account of the higher floor

(*Continued on p. 475*)

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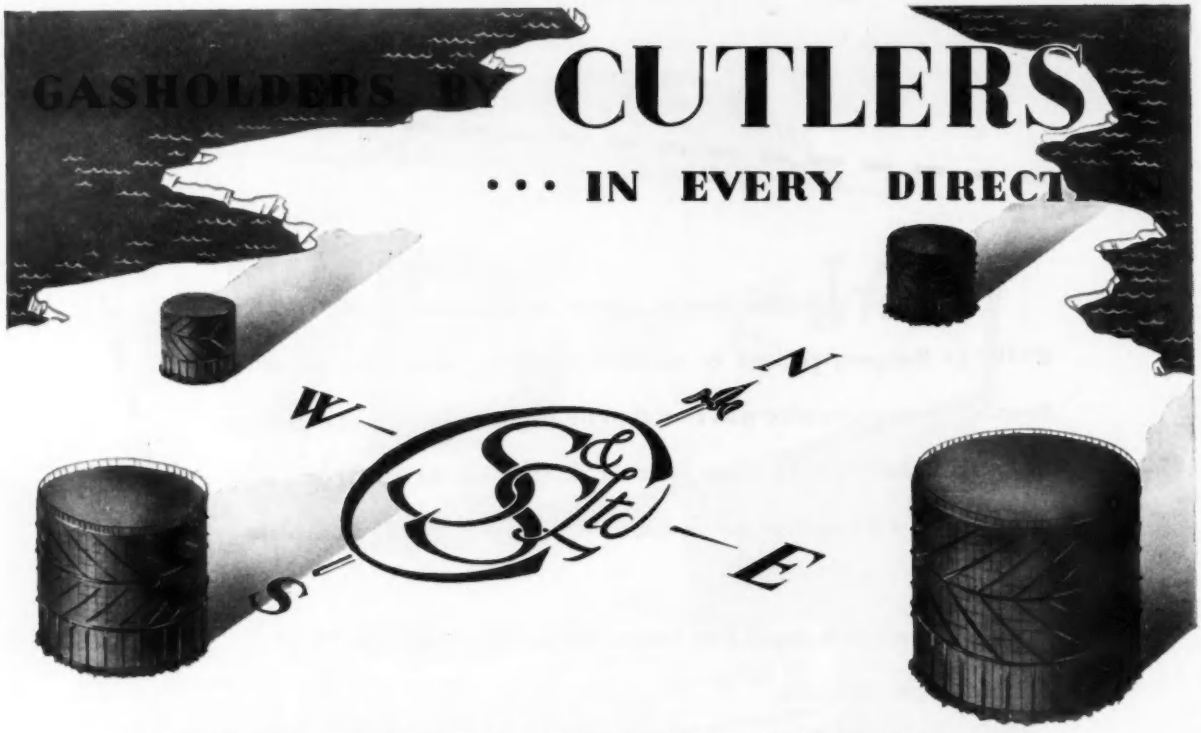

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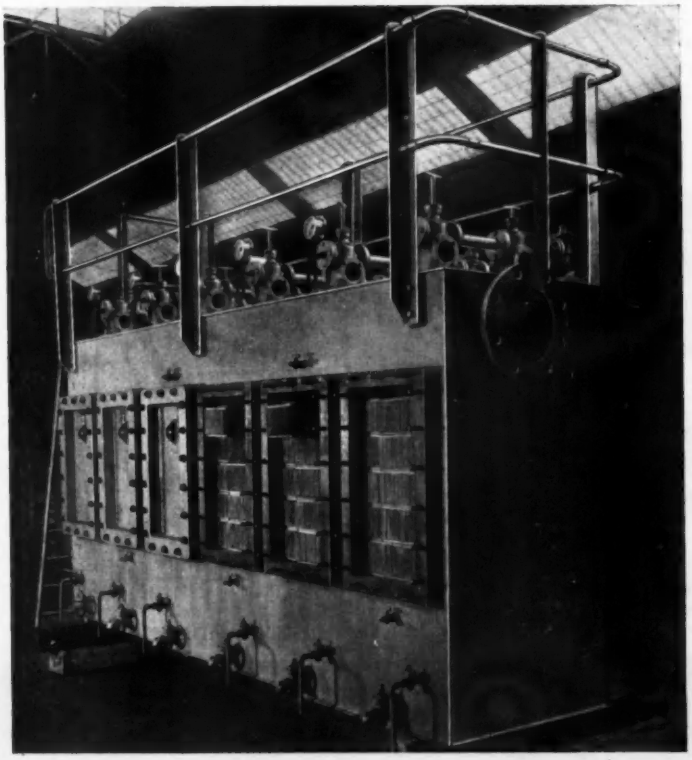

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temperature and lower temperature gradient when the gas fire is used. It is clear that, when making a calculation of the true heat requirements for the purpose of determining the appliance size, there is little reason for allowing a 5°F. lower air temperature when radiant heating is used. It is fairly evident that what really happens is that if the heat input is the same for mainly convective and mainly radiant heating respectively, the air temperature will inevitably be lower in the latter case, but on account of the radiant heat and higher surface temperatures, the comfort level might well be higher.

Published papers on the subject of intermittent heating have confirmed the need for adequate preheating power, and experimental work by L. Pederson ([9]) in Denmark, with low temperature suspended ceiling panels designed to provide a field of radiant heat, showed that for a heat input equal to the steady state value the preheating time was 14 hours, and for a heat input equal to twice the steady state value, the preheating time was reduced to between three and four hours. In all cases intermittent heating was more economical in fuel than continuous heating.

Billington ([9]) has shown that the heat flow to a floor for periodic heading is from one and a half to three times the steady state value, depending on the type of floor construction.

A further important contribution to the study of intermittent heating has been made by F. C. Becker and N. F. Bisgaard ([11]), who have used a different method of computing non-stationary temperatures, the method being similar in some respects to that employed here. They have applied the method to a number of practical problems successfully. In an example for a room heated intermittently, the following results were obtained:—

Mean outdoor temperature 3.5°C. (38.3°F.).
Mean indoor temperature 19.0°C. (66.2°F.).
Ventilation rate—20 cu. m. per hour (700 cu.ft. per hour).
Hourly heat loss (steady state) 500 K.cal per hour (1,990 B.Th.U. per hour).
Hourly heat loss (periodic state) 626 K.cal per hour (2,470 B.Th.U. per hour).

$$\text{Ratio } \frac{\text{Periodic state}}{\text{Steady state}} = 1.25$$

The heating was mainly convective in character and the preheating time was between three and four hours. Here again, the need for preheating power is confirmed and it is shown to be calculable.

On the comparison of radiant and convective heating, Bedford and Fishenden([10]), referring to work by Dufton, mention that, although the heat input to a room was greater when using a gas fire compared with convection heating, the equivalent temperature in the room when heated by the gas fire was 19° above the outside temperature whereas with convection heating it was only 11° above outside temperature. This again emphasises the erroneous conclusion that can be reached by using the air temperature only as an index of comparison.

'Absorbence' of Building Structures

Any examination of the subject of intermittent heating would be incomplete without mention of the work of Professor E. G. Smith ([12]), ([13]), ([14]) in America. In the author's opinion this work has received all too little attention. In this method of computation of the heat requirements of intermittently heated buildings the calculation is divided into two parts:—

(i) The periodic state resulting from the cyclic rise of temperature each day.

(ii) The steady part of the cycle represented by the difference between the minimum temperature of the cycle and outside temperature.

The 'absorbence' of a wall is defined as a number which, when multiplied by the product of the desired increase in the indoor temperature and the surface area of the wall, results in a number of heat units which must be supplied to the wall in order to secure the desired increase of indoor temperature in a specified time. 'Absorbence,' therefore, is a function not only of the type of wall, but also the time which may be allowed to produce the desired rise in temperature.

The calculation of an absorbence value involves a rather long calculation, including the summation of an infinite mathematical series, but it is generally unnecessary to extend the summation beyond five terms and, for an approximation sufficiently close, often less than this. Once the absorbence is obtained the application of the method is no more tedious or difficult than the normal conductance calculation. E. G. Smith ([12]) has prepared absorbence tables for a wide variety of building components and materials and a similar table for the methods of construction used in this country would be of great value. This is receiving consideration.

Table IV gives some typical absorbence values compared with steady state heat value:—

TABLE IV.—Absorbence Values

Building Component	Preheating time in hours					Overall steady state 'U' value	Ratio $\frac{a \text{ (3 hours)}}{U}$
	½	1.0	2.0	3.0	4.0		
9-in. brick wall	1.140	1.021	0.890	0.810	0.748	0.46	1.76
9-in. brick wall ½-in. plaster	1.140	1.021	0.890	0.814	0.760	0.42	1.94
6-in. concrete	1.283	1.118	1.075	1.001	0.948	0.61	1.66
9-in. brick wall—plaster covered with 1½ in. Celotex	0.402	0.298	0.231	0.219	0.210	0.17	1.29
6-in. concrete plaster, 1½ in. Celotex	0.430	0.300	0.233	0.220	0.217	0.19	1.16
4½-in. brick interior, wall plastered each side	1.141	1.011	0.842	0.720	0.629	0.53	1.36
6-in. concrete floor on soil	1.28	1.090	1.040	0.950	0.870	0.20	4.30

To apply the absorbence method the calculation is made as follows:—

t_1 = minimum indoor air temperature of the heating cycle.
t_2 = desired maximum indoor temperature.
t_0 = outside temperature.
U = steady state overall heat transmission coefficient.
a = 'absorbence.'

Heat requirement $= a(t_2 - t_1) + U\ (t_1 - t_0)$ B.Th.U./sq.ft./hr.

The above method, used for the room to which the previous analysis applies, gives results shown in Table V, where a comparison is made with the previous calculated values. Allowance for the radiant heat is made by using the equivalent convective temperature in place of t_2 in the above equation. For convective heating the maximum air temperature t_2 is 60°F., and the overnight temperature t_1 is 45°F., while the outside temperature t_0 is 30°F.

TABLE V.—Comparison of Calculated Heat Requirements

Method of Calculation	Heat requirements B.Th.U. per hour	
	Wholly Convective heating	Mainly Radiant heating
(1) Steady state	6,260	6,260
(2) Wall temperature method from previous section	7,600	10,500
(3) Absorbence method	7,660	9,800

Comparison of the results obtained with the two methods of calculation, allowing for the periodic rise of internal temperature, shows reasonable agreement, the latter method being much easier to apply, once the absorbence values are known.

Appliance Rating and Pre-Heating Power

It should be appreciated that appliances having an output equal to the steady heat loss will not reach the temperature on which the loss is computed unless time is long. Appliances so rated are adequate for the larger part of the heating season, however, and during the colder weather there is little doubt that it is the existence of

the radiant heat which provides an acceptance level of comfort, although in a smaller zone. It must be remembered that the calculations refer to a room of 1,400 cu.ft. capacity, with outside walls and floor having 'U' values consistent with the Egerton standard, heated to an air temperature of 60°F. The heat requirements of a more normal room would be correspondingly higher.

The ventilation rate assumed is that for a gas fire and with an open coal fire, without restricted ventilation. An appreciable addition to the heat requirement would be necessary to account for the extra ventilation loss; this would amount to between 1,500 and 2,000 B.Th.U. per hour in the case examined. An open solid fuel fire, without chimney restriction, would require an output of from 12,000 to 13,000 B.Th.U. per hour to reach a temperature of 60°F. in three hours with an outside temperature of 30°F. In a more normal room the requirement would be higher. This figure should be compared with a steady state loss of about 8,200 B.Th.U. per hour, the figures quoted referring to an unfurnished room.

The Effect of Furniture

The effect of furniture on the thermal conditions of a room is much too important to be ignored and it is possible to estimate the amount of heat absorbed by furniture by several methods. Bruckmayer ([1]) deals with the heat storage effect of furniture under the term of 'intramural heat' (Kernwaerme=core heat) and shows that this may be regarded as compensating for the high rate of heat loss through the windows. He suggests that a room having a total internal content of 1,000 kg. (2,200 lb.) including timber, furniture, books, china and glass, iron and metals, clothing and carpet materials has a heat storage capacity of 432 kg. cal. per 1°C. rise in temperature—*i.e.*, 950 B.Th.U. per 1°F. This room would appear to be a well stocked room, but the figures indicate that the amount of heat required by internal storage heat is appreciable and it is a factor which must be accounted for when the heating is intermittent. It retards the heating up of the room if air temperature is the criterion, but also delays the cooling down overnight.

Radiant heat is absorbed directly by the furniture and it is possible to make an estimate of the amount absorbed by use of a sinusoidal diagram using iso-intensity distribution lines.

In one example examined in this way the estimated rates of absorption of radiant heat by the various articles of furniture were:—

Left-hand fireside chair	550	B.Th.U. per hour
Right-hand fireside chair ..	440	"
Settee	310	"
Sideboard	220	"
Table	280	"
Total	1,800	B.Th.U. per hour

This figure represents about 25% of the radiant heat leaving the fire and would not be directly lost to the walls, floor, etc., but would eventually result in raising the air temperature in the room by convection from the furniture. This would tend to reduce the difference in the air temperature reached by an equal input of heat by convection or by radiation.

The internal storage heat is extremely useful heat, as the raising of the surface temperature of the furniture has a greater effect in raising the comfort level than does the wall temperature, owing to the closer proximity of the furniture to the occupants. The rise in the internal storage temperature is more rapid with radiant heating, and here is another advantage when the heating is periodic in character.

The actual heat losses from the room would be reduced by the amount of heat absorbed by the furniture, but 'intramural heat' requirement must be satisfied in some way or other for equal comfort standards. Broadly speaking, the rise in air temperature in a furnished room would be higher with radiant heating and lower with convection heating compared with an unfurnished one; in fact, the air temperature produced with mainly radiant heating might not be much below that for convective heating.

Experimental evidence has been provided by Billington([18]) where he found that, other things being the same, with radiant heating by a flued gas fire the *equivalent temperature* in a furnished room averaged 5°F. above that of an unfurnished room. It was concluded that, by intercepting radiation from a fire, furniture has a definite effect upon the warmth produced, in the particular case studied causing a 25% increase in the warming effect.

It is difficult to make an accurate allowance for furniture when estimating the heat requirements of a room. The amount and type of furniture relative to the size of the room vary over a very wide range. It is probable that from 15% to 30% of the heat input to the room is absorbed by the furniture, the air temperature being affected in the manner suggested when the heating is periodic. The furniture must be considered as an addition to the thermal capacity. For a particular temperature, it represents an addition to the heat requirement for convective heating, resulting in a lower temperature than would otherwise be obtained, whereas with radiant heating it is mainly intercepted heat tending to reduce the heat loss to walls, etc.

The Problem of Thermal Comfort

Although a great deal of work has been devoted to this subject, the complexities of the problem are such that it is an extremely difficult matter to devise a simple criterion for comparison of different methods precise enough to make accurate quantitative deductions. The gathering and analysis of data on thermal comfort are long and tedious tasks, and for this reason alone this field has attracted far too few workers. It is regrettable, however, that because of the difficulty of formulating exact criteria, the question of relative comfort levels has been largely ignored in recently published reports and summaries on domestic heating. The author freely admits that such parameters as mean weekly house temperature, mean living room air temperature, etc., are convenient and often necessary in making broad comparisons of overall efficiency of like heating systems, but the concern is with the heating and comfort of people, which, although related to air temperature levels, depends on many more equally important factors. The work of Bedford, Vernon, Fishenden, Dufton, and others eminent in this field is too well known for other than mention here, but their comparisons were nearly always made using the 'Equivalent or Comfort Temperature.'

It would be advisable perhaps to restate briefly the main considerations for thermal comfort given by Bedford([14]):

(i) The room should be as cool as is compatible with comfort.
(ii) The temperature of the surroundings should be slightly higher than the air temperature.
(iii) The temperature at floor level should be slightly higher than at head level.
(iv) The radiant intensity at head level should not be too great.
(v) There should be sufficient air movement to promote a feeling of 'freshness.'

With mainly convective heating, the requirements set out above cannot be satisfied, (ii) is impossible, and (iii) which implies—in the absence of the ideal negative temperature gradient—that the temperature gradient should be as low as possible, would certainly be difficult to approach, for the temperature gradient is often abnormally high with convective heating.

The use of high temperature radiant source in a room offers one approach which overcomes some of the deficiencies with mainly convective heating, particularly if the source has a well-designed radiant heat distribution. A further factor often emphasised is that variability in comfort level in a room, rather than a constancy of condition, is preferable, the former providing stimulation, the latter tending to monotony.

The need for variability not only arises from consideration of a single individual, but in a living room or lounge there is nearly always a group of persons, each requiring a slightly different standard of comfort.

Having briefly stated some of the problems, methods of heating in relation to them may be examined. It must first clearly be understood that heating entirely by one method, while suitable for some situations, is not likely to satisfy others. For an individual or single occupant radiation alone may often be enough, but, for a group, a combination of both methods is more satisfactory.

Reference to the analysis of air and surface temperatures, given in Table II, indicates the differences between mainly convective and mainly radiant heating. For the conditions stated, given due weight to the relative areas of floor and walls, and ignoring, for the moment, the direct warming effect of the radiant heat, an approximate comparison of comfort level is shown in Table VI.

TABLE VI

Type of Heating	Air Temperature	Average Surface temperature °F.	Average Equivalent temperature
1. Convective	60	55.7	55.5
2. Mainly radiant ..	60	61	58
3. Convective	65	59	59.5

The above comparison ignores the effect of relative position of subject and surrounding surfaces and furniture. The advantage, however, would tend to be with the radiant heating on account of these factors, as the furniture and floors would tend to be warmer, in comparison with other surfaces.

Based on this simple comparison, which, if not exact, can be taken as indicative, conditions (1), (2) and (3) appear better satisfied with radiant heat present. It suggests that radiant heating with an air temperature of 60°F. is roughly equivalent to convective heating with an air temperature of 65°F. The equivalent temperatures reached are, however, at the lower end of the comfort scale, and when due consideration is given to the higher temperature gradient which would exist in practice with convective heating, it is doubtful whether the latter would be comparable with the former.

Radiant Heat Distribution in the Room

In the promotion of comfort the radiant heat distribution characteristic is important and in this connection it is of interest to compare a gas fire with a normal solid fuel fire of modern design.

The main difference in distribution characteristics has been previously discussed by E. F. Du Bois([17]) and more recently by F. J. Eaton([32]); this can be pursued a little further. Table VII shows the distribution of the radiant heat in the room mentioned earlier, for a gas fire having a gas rate of 32 cu.ft. per hour and a coke fire when fully alight and burning at a combustion rate of 3.4 lb. of coke per hour.

TABLE VII.—Radiant Heat Distribution

Component	Gas Fire			Coke Fire		
	Radiant Heat received B.Th.U. per hour		Proportion	Radiant Heat received B.Th.U. per hour		Proportion
	Total	Average per sq. ft.		Total	Average per sq. ft.	
Floor	2,880	17.8	0.40	2,980	18.4	0.20
Ceiling	1,100	6.8	0.15	5,680	35.0	0.38
Front wall (opp. fire) ..	1,610	14.0	0.22	2,080	18.1	0.14
Right-hand wall ..	780	7.5	0.11	1,980	19.5	0.13
Left-hand wall	830	8.2	0.12	2,230	21.8	0.15

This comparison emphasises the difference between the two forms of heating and the author suggests that the gas fire possesses marked advantages when reference is made to the desirable qualities of a comfortable environment, given by Dr. Bedford. Warming the lower levels of a room is always a desirable feature.

The effect on the temperature gradient of the generally low level distribution of radiant heat from a gas fire is well illustrated by Fig. 4, which shows the air temperature records obtained from the centre of a room having a convector gas fire with some background heating by warm air. The initial temperature difference between the 7 ft. and 2 ft. levels is seen to be about 8°F. On lighting the gas fire and, despite the appreciable rise in air temperature, the final temperature difference does not exceed about 3°F. What is more important is that the temperatures at the 2 ft. and 5 ft. levels are nearly the same.

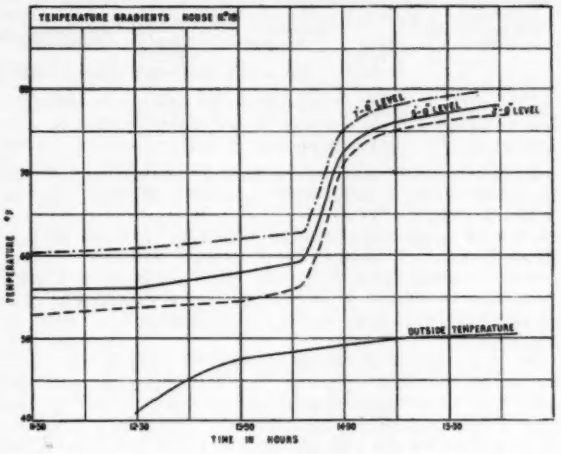

Fig. 4

Radiant Heat Received by Occupants

In the previous sections the radiant heat from the fire directly received by the occupants has been ignored and here lies the main advantage of high temperature radiation in intermittent heating. The importance of this factor has often been under-estimated and in many cases largely ignored when comparison has been made between different methods of heating. When the heating is periodic or transient in character, the great advantage of the direct warming of occupants by radiant heat is indisputable. The amount of radiant heat received by occupants is quite considerable, a fact which is sometimes not fully appreciated. It perhaps becomes more apparent when it is realised that an occupant, seated in the vicinity of a fire, subtends an appreciable solid angle.

Table VIII deals with a seated occupant facing the fire at a distance of 4 ft. 6 in. from the fire to the front surface of his body.

TABLE VIII.—Radiant Heat Incident upon Seated Occupant

Lateral angle of position of occupant to plane of fire	Total radiant heat received B.Th.U. per hour	Radiant heat received		Ratio: Heat below waist / Heat above waist
		Below waist B.Th.U. per hour	Above waist B.Th.U. per hour	
30°	423	239	184	1.30
45°	792	408	384	1.06
90°	1,045	569	476	1.20

Firstly, it can be seen that the radiant heat received by the seated occupant is appreciable and providing the back conditions are above the minimum for comfort, the rise in comfort level experienced by the occupant is almost immediate and air temperature becomes of lesser significance. The second, and very important, point is that the higher proportion of the heat is incident below the waist. In the heating of human beings in contradistinction to the noble art of self-defence aiming 'below the belt' is to be encouraged.

A further comparison is made in Table IX between a gas fire and solid fuel fire, the seated occupant being at different distances from the fire at a lateral angle of 45° to the plane of the fire, chosen as a reasonable average.

TABLE IX.—Comparison of Radiant Heat on Occupant from a Gas Fire and Solid Fuel Fire

Distance of occupant's body from fire	Gas Fire		Coke Fire	
	Total B.Th.U. per hour	Proportion: Below waist / Above waist	Total B.Th.U. per hour	Proportion: Below waist / Above waist
4 ft. 6 in.	792	1.06	1,129	0.846
5 ft. 6 in.	498	1.08	—	—
7 ft. 6 in.	249	0.79	387	0.520

It can be seen that the radiation incident upon the occupant varies greatly with distance from the fire as would be expected, but a variation in comfort level in a room has been shown to be far from a disadvantage. There is definitely a need for a variable standard of comfort in a room with a normal family and, with a high temperature radiant source supplying a reasonable proportion of the heat input, this variation in level is obtainable.

With the gas fire, the proportion of radiant heat falling below the waist is always much higher than with the coke fire. The 'radiant intensity gradient' in the former case is much more preferable. The difficulties in distributing more of the radiant heat at lower levels with the modern solid fuel grate are appreciable; nevertheless, this question of distribution characteristics and its effect on comfort is one of utmost importance.

A further important factor which intrudes is that of ventilation rate which is often far too great in the case of the solid fuel grate, bearing in mind that a large proportion of the incoming cool air sweeps across the floor, thereby accentuating the adverse 'comfort gradient.' Chimney restriction and reduction in excess ventilation are now receiving serious attention, but together with this the whole ventilation system of the room should be considered and the author suggests that high level ventilators with upwardly inclined louvres communicating with the hall and of adequate size, could help towards reduction of floor draughts.

Comparison of Comfort Levels

Again, assuming that the average standard in the room is commensurate with minimum comfort and the equivalent temperature is as indicated in Table VI, it is possible to estimate the rise in M.R.T. and, hence, equivalent or comfort temperature resulting from the direct radiant heat. In the comparison which follows it has been assumed that the surface area of the occupant exposed to radiant heat and surroundings is 16 sq. ft., which allows for that part in contact with the chair.

TABLE X.—Effect of Direct Radiant Heat

Lateral position angle	Distance from fire	Total radiant heat received	Average intensity per sq. ft.	Estimated M.R.T. including direct radiation	Equivalent temperature of occupant
30°	4 ft. 6 in.	423	33.6	94	74
45°	4 ft. 6 in.	792	44.0	104	78.5
90°	4 ft. 6 in.	1,045	58.0	116	84.3
45°	5 ft. 6 in.	498	39.5	102	77.5
45°	7 ft. 6 in.	249	13.6	76	65

Table X, incomplete as it is, shows that the direct effect of the radiant heat is of paramount importance, raising the comfort level far above that indicated by any air temperature determination. In each of the positions shown, the comfort level is well above the necessary level, meaning that a good standard of comfort is attainable in quite a wide zone in a much shorter time than the three hours taken.

The other important factor is that a variation of comfort level can be satisfied simply by alteration of position by the occupants. These matters are, of course, well known, but because of the inherent difficulty in giving the various factors a precise weight, they are being ignored altogether and this is to be deprecated. Taking, for instance, the position at 45° and 7 ft. 6 in. from the fire, with convection heating to 65°F., the equivalent temperature would be about 59°F., and is therefore just acceptable. Wherever one moved in the room the level of comfort would not vary much above or below this level, but would get less towards the room boundaries.

With radiant heat present and an air temperature of 60°, the equivalent temperature is 65°F. and therefore much more acceptable, as it is towards the upper limit of desirable comfort. The minimum comfort level in the room would be as good as with the higher air temperature and convection heating, while in a very wide zone much higher levels of comfort are possible. If the effect of temperature gradient is included the bias is still more towards the radiant heating.

It is doubtful whether an air temperature of 65°F. is sufficient in a normal room when the heating is periodic and mainly convective. Houghton and McDermott[18] have shown, for instance, that with walls at 45°F. surface temperature, an air temperature of 79°F. is necessary to establish comfort under American conditions. An approximate guide is that, for every 1°F. drop in M.R.T., an equal and opposite rise in air temperature is necessary for compensation.

An Inadequate Index

The author freely admits the inadequacy of this treatment of the subject and can only urge that the air temperature is an utterly inadequate index for the comparison of different types of heating. It has been demonstrated repeatedly that floor temperatures, wall temperatures, 'freshness' factors are at least of equal importance and every effort should be made to give them full consideration. There should be little difficulty, for instance, in estimating the 'comfort level' in the centre of a room and the equivalent temperature is as suitable as any index yet devised for this purpose. Globe temperature also is a simple and more reliable index than an ordinary air temperature, making at least some allowance for the radiant heat.

It is significant that much more attention is being devoted to the subject of radiant heating in America, a country with previously strong inclinations towards central heating and warm air heating. In that country E. F. Du Bois recently asked a somewhat pertinent question, in a typically American manner, 'Why heat 100 tons of brickwork when you can warm 100 lb. of grandmother?'

The regard for the open fire in this country is rather more than psychological. Some radiant heat is almost an essential for thermal comfort under conditions of intermittent or periodic heating. Its absence in the average English home would make conditions intolerable, particularly in the colder weather. Even where central heating and other forms of whole house heating[19] have been used, the need for a source of high temperature radiant heat has been appreciated, because of the apparent inability of such systems to provide the required comfort in the colder weather without, perhaps, more continuous use and consequent increase in fuel consumption.

Reflective Heating

From the earlier sections it is obvious that when radiant heating is used the heat loss to the surroundings is increased by the direct absorption of radiation at the surfaces, compared with convective heating for the same room temperature. The comfort effect is greater owing to the higher surface temperature, but at the expense of increased heat requirement, ignoring the effect of furniture and radiation directly received by the occupants.

Occupants, furniture, and room boundary surfaces all have fairly high coefficients of absorption and for the first two items this can be regarded as a good feature, but for the boundary surfaces, apart from, perhaps, the floor, which needs to be warm, it would be advantageous if the surfaces were of low absorptivity and high reflectivity. This would mean that all radiant heat at such surfaces would suffer multiple reflections and would finally be absorbed by surfaces (including occupants) which had high absorption values.

A good deal has been written on this subject, including the work of Winslow *et alia*[21], who show in a 'controlled weather room' with continuous heating that the heat requirements were reduced from 100 to 79 units. With

periodic heating the corresponding figures were 85.5 and 66.5. The savings could be accounted for by the reduction in 'U' value, but this referred to mainly convective heating and a different periodicity of the heating compared with normal domestic heating in this country. The absorption of reflected radiant heat by occupants and furniture are factors not accounted for in this work. Griffiths, from studies on a model room, states that the effect of reflectivity was not large until the reflectivity was greater than 0.5 to 0.6. This work was again without the effect of absorption by furniture and occupants.

In America, Dr. Clarence E. Mills([22]) has studied reflective radiant conditioning in a specially equipped research residence which had highly reflective wall coverings, curtains with reflective linings, and with carpeted floors. The wall papers were embossed and apparently acceptable with regard to appearance.

During the heating season it was concluded that the heat requirement was only 60% of the steady state calculated requirement and that comfort was achieved at only 55% of the calculated heat load during a very cold period. The rug and floor temperatures exhibited a very interesting behaviour. When the air temperature near the nylon carpet was 62°F. the carpet temperature was 76°F. Even near the room boundaries the carpet temperature was 74°F. The carpet, by reason of its relatively high absorptivity compared with other surfaces, had become a secondary radiator. This factor must have had an important bearing on the comfort level and, of course, is an effect that is highly desirable.

The general attitude towards reflective linings is that they have a somewhat bizarre visual effect, but it would appear from Dr. Mills' work that here is a subject worthy of further serious study. In the room previously mentioned in this paper the radiant heat reaching the walls in a furnished room is from 20% to 30% of the total radiant heat output of the gas fire. With wall surfaces of 0.7 to 0.8 reflectivity it would seem that from 15% to 20% of the heat, which would normally be absorbed by the walls, might be reflected and finally absorbed by the internal components of the room and the floor. With periodic heating, this amount could be important enough with regard to an earlier establishment of comfort. Its overall effect would be to reduce the heat input necessary for comfort. Whether it would be sufficient to justify the visual unusualness of wall coverings with a sufficiently high reflectivity is another matter.

The whole matter of reflective heating is of great interest, but carefully controlled tests in occupied rooms, heated by single high temperature radiant appliances, are necessary to determine the physiological and psychological reactions which reflective linings would produce.

Appliance Design and Rating

The preheating power necessary in intermittent heating may be available in a particular appliance by operating at a higher combustion rate, and this feature is probably more essential where little radiant heat is available, simply because an occupant cannot avail himself of the flexibility introduced by moving to a zone of higher comfort which is possible with appliances giving a reasonable proportion of radiant heat.

To design appliances with outputs adequate for the attainment of full comfort in a reasonable time would be a wrong policy, unless controllability and flexibility, which are of importance perhaps equal to, if not greater than, maximum output, were at the same time improved. From the aspect of fuel economy, average weather conditions must be given due consideration. Overheating, which would inevitably occur with a higher rated appliance lacking controllability, would lead to wasteful usage of fuel. In the absence of adequate controllability, it is no doubt correct to consider average conditions when deciding the size and rating of the appliance, but there is little doubt that the insufficiency of preheating power of solid fuel appliances, together with, perhaps, shortage of solid fuel, increases the use of gas and electricity for space heating during extreme conditions.

The design of solid fuel appliances to provide a sufficiency of heating output with a reasonable amount of radiation and with adequate controllability is far from an easy matter, but the addition of a more flexible component in the form of an integrally included gas fire may be one approach. A Fulham gas and coke fire is at present under development and district test.

Function of the Gas Fire

The main purpose of the gas fire addition is that it provides a means of heating during the milder parts of the heating season and for short period heating when the use of a solid fuel fire can be wasteful. A secondary purpose is to use the gas fire as a boost during the ignition period of the coke fire. It is not intended that the gas fire and the coke fire shall be in use together for long periods and, in the main, this would be unnecessary. While a good deal of this discussion has been devoted to the importance of radiation, there is little doubt that the direct warming of the air by convection adds to the general level of thermal comfort, particularly if the convection is an added component leading to a greater overall appliance efficiency with a resulting likelihood of fuel economy.

The use of a finned back boiler with a coke fire, or with the gas and coke fire already mentioned, permits the use of hot water radiator surface in the same room as the appliance, so providing a higher background level of temperature than would otherwise be the case. During actual periods of occupancy the radiation component can be increased by using a higher combustion rate and the rise in comfort level, therefore, starts from a higher initial value. The inclusion of the radiator surface can be regarded as adding to the flexibility of the heating installation, quite apart from the increase in overall efficiency which results.

Another type of appliance, which certainly possesses the advantage of controllability, is the openable stove. It is not a widely used appliance for perhaps a variety of reasons, including cost and a possible preference for the open fire, yet the heating stove is an efficient appliance having a wide range of combustion rate and a reasonable radiant output when used with the doors open. It has the disadvantage of establishing a high temperature gradient and is often criticised for producing a dry atmosphere lacking 'freshness' when closed. When used with open doors, however, the ventilation rate is greatly increased above that of the closed position and a reasonable 'freshness' should be possible.

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(To be continued)

BOOKS RECEIVED

P.A.Y.E. SIMPLIFIED

Income tax calculations, even in the smallest business concerns, have become increasingly complicated since the introduction of P.A.Y.E., and anyone who helps to simplify them deserves thanks. One of the most useful aids we have seen for some time is *Whillan's Tax Tables and Tax Reckoner*, 1953-54, published by Butterworth & Co. (Publishers), Ltd., 88, Kingsway, W.C.2, at 5s., with reductions for quantities. The author is George Whillans, a Fellow of the Institute of Bankers, Fellow of the Institute of Taxation, and Fellow of the Royal Economic Society. The 11 pages of tables, printed on good strong paper to withstand frequent handling, include grossing up and tax charts, tables of income tax rates and reliefs, surtax rates, rates of estate duty, P.A.Y.E. codes, and ready-to-hand notes about national insurance contributions, property statutory repairs allowances, and double taxation agreements.

INSTRUMENT MANUAL

The United Trade Press, Ltd. (9, Gough Square, London, E.C.4), publishers of the monthly journal *Instrument Practice*, have just issued a new edition of the *Instrument Manual*, a comprehensive work of nearly 750 quarto pages covering the latest available information on instrument technology, measurement and control, telemetering, accessories, and components. The new *Manual* is the second edition of a work which when first published in 1949 was sold out in a relatively short period. Within the short time that has elapsed since then there have been further advances in the application of instrumentation in many industries. Two original sections have been eliminated but many new sections have been introduced. Over 30 instrument manufacturing firms have co-operated in the compilation of the new issue. A buyers' guide at the end of each section has been made as complete as possible, whether the particular instruments have been described in the section or not. An accessories buyers' guide at the end of the book has been enlarged many times and a directory of manufacturers has called for proportionate increase. The *Manual* is published at £4 4s. post free.

CABMA REGISTER, 1953

Published jointly by Kelly's Directories Ltd., and Iliffe & Sons, Ltd., for the Canadian Association of British Manufacturers and Agencies (managers of British trade centres in Toronto, Vancouver and Montreal), the first edition of the *CABMA Register of British Products and Canadian Distributors* provides a comprehensive volume of reference to British suppliers and their products. Its 620 pages provide a buyers' guide of over 3,750 British manufactured products with more than 1,300 cross references. Over 4,500 British manufacturers are included, giving over 2,750 Canadian distributors listed in relation to the English firms. The volume is sectionalised, divided for easy reference by index guide cards with reinforced tabs.

The buyers' guide is an alphabetical list of British products for Canada, with the names of the British and Canadian suppliers classified under the product headings. In an alphabetical directory of British manufacturers and distributors British firms are first listed with full details, including their distribution arrangements in Canada, and a similar list of Canadian suppliers follows. Two further sections enable the products and their sources of supply to be identified from their proprietary names and trade marks respectively. The book contains goodwill messages from the President of the Board of Trade, the Chairman of the Dollar-Sterling Trade Council, the Chairman of the Dollar Exports Council, and the President of the Canadian Association of British Manufacturers and Agencies. The *Register* is published at 42s. (by post 44s.).

MODERN PRINTERS YEAR BOOK

Of no less interest to print users than to printers is the 1953-54 edition of the *Modern Printers Year Book*, printed and published at 4s. by Bendles (Torquay), Ltd. This is the third issue of what was formerly titled the *Small Printers Year Book*, the new name being more in keeping with the wider scope of the publication which, in its 186 cap 8vo pages, comprises 35 tables for everyday use, including a block calculation chart and up-to-date purchase tax table. A directory of suppliers contains 48 pages and over 150 classifications in alphabetical order, listing some 900 names, addresses, telephone numbers, and sources of supply. Editorial articles include one on 'Estimating and Costing' by A. D. Hull, Costing Secretary to the British Federation of Master Printers; one on 'Small Offset Machines' by E. L. Childs, Editor of the *Small Offset User*, and an artcile on 'Selling Print,' by an anonymous contributor.

SIXPENNY TREASURE GUIDE

Jubilant in recording a successful 1952-53 season, the latest edition of *Floodlight* (reduced this year to 6d., at bookstalls) is eager to encourage similar enthusiasm for the approaching session of further education at the L.C.C. colleges and institutes beginning in September. *Floodlight* now omits information about day, full-time and part-time courses, these being dealt with in a separate pamphlet. Over 30,000 students again attended last year, excluding full-time attendance. Student hours in all forms of further education by the L.C.C. now reach a total of nearly 33 mill. a year. This year, class fees are slightly higher, a fact which *Floodlight* does not attempt to explain, but still precious knowledge is to be had for a ridiculously small outlay. Gas engineering may be studied at two colleges in preparation for the Institution of Gas Engineers and City and Guilds exams, and in fact there are courses for ambitious men in nearly every employment connected with the gas industry: Technologists, fitters, gas salesmen, law accounts employees of gas supply corporations.

Floodlight, however, does not merely concern itself with the improvement of professional and trade standards. Here are opportunities for young and old to develop new interests; to become proficient at household handicrafts or popular with puppetry, conversant with classical Greek or confident at car repair. The foreword sums up the facilities offered without undue modesty. 'For a few shillings,' it says, 'a student can receive a year's instruction in a subject which will improve his or her professional status, craft or skill, artistic ability or physical fitness. There is no greater investment in life, as the greater one's interest, the higher the dividend.'

B.I.M.C.A.M. HANDBOOK

A team representing the Organisation for European Economic Co-operation which recently studied the part played by process instrumentation in the United States reported that 'means should be devised for disseminating information among those who control policy in industry; the problem is to find a means of converting management to the habit of mind which demands efficient instrumentation.' To illustrate the achievements and potentialities of instrumentation and control, the British Industrial Measuring and Control Apparatus Manufacturers' Association produced its first *Handbook* during the period of the recent British Instrument Industries Exhibition. By way of preface the *Handbook* opens with brief messages from the leaders of a few of the industries which benefit most from modern instrumentation, including Mr. G. E. Currier, President of the Institution of Gas Engineers for 1952-53, and Dr. G. E. Foxwell, President of the Institute of Fuel. Following notes on the industry and its Association, the book contains particulars of members of the Association, lists of their products, and members' announcements. To keep pace with the growing demand for all types of industrial instruments it is conservatively estimated that compared with 1938 the labour force of the industry has doubled and the value of its output multiplied by five.

COPPER IN INSTRUMENTATION

Now that copper and its alloys are freely available, and their use for any purpose is unrestricted, there will be added interest in *Copper in Instrumentation*, a new 152 pp. publication of the Copper Development Association. The aim of the book is to show the part copper and its alloys play in industrial instrumentation and automatic control apparatus. It covers the use of these materials in ordinary and ancillary equipment, instrumentation being commonly defined as the industrial application of the science or technology of measurement and control. No attempt is made to deal with laboratory or purely scientific instruments, and the scope of the book is restricted to instruments of types most commonly used in industry. Instruments are considered under three main headings: pressure and strain-responsive instruments; electromagnetic instruments; and temperature-responsive instruments. Sections are devoted to the application of copper alloys to diaphragms, capsules, bellows, Bourdon tubes, strain gauges, coils, shunts, etc., and the book includes an extensive bibliography. Copies of the book are obtainable free of charge on application to the Association at Kendals Hall, Radlett, Herts.

The British Gas Staff Association has arranged to hold its annual meeting next year at Bournemouth. Mr. J. T. Haynes, Divisional General Manager at Bournemouth and this year's President of the Institution of Gas Engineers, which will also meet at Bournemouth next June, has offered his support.

Fewer and Larger Tar Distilleries

Continued Trend Towards Centralisation

THE Chief Inspector for England and Wales, Mr. W. A. Damon, and the Chief Inspector for Scotland, Mr. E. A. B. Birse, have submitted to the Minister of Housing and Local Government and the Secretary of State for Scotland their reports on the work done during 1952 in carrying out the provisions of the Alkali, Etc., Works Regulation Act, and in the reduction of atmospheric pollution caused by industrial processes. The combined reports constitute the 89th of the series under the Act and earlier legislation. Works registered in England and Wales under the Act in 1952 totalled 964, involving the operation of 1,785 separate processes. Compared with 1951 there was a decrease of seven in the number of works but an increase of 12 in the number of processes operated. In Scotland the statutory register bore the names of 83 works which had 122 manufacturing processes requiring inspection, a net increase of nine in the number of works and an increase of 11 in the number of processes. A new Alkali, Etc., Works (Scotland) Order, which came into force on July 1, resulted in 11 more works and 12 more processes being added, and in addition at three works already registered four processes came under inspection for the first time.

The report states that the greater use of gas and electricity instead of coal for heating pottery kilns has reduced smoke pollution in the Potteries in spite of increased production of ware. It has been reported (K. Davis, Midland Junior Gas Association) that the consumption of gas for the actual firing of pottery rose from 36¼ mill. cu.ft. in 1933 to approximately 4,600 mill. cu.ft. in 1952. A further 1,000 mill. cu.ft. were used for other processes connected with the pottery industry. It has been further stated (J. E. Stanier 'The Utilisation of Town's Gas in the Ceramic Industry') that a ton of coal utilised at a gasworks can supply the necessary amount of gas for firing the same quantity of ware as would require 1.2 tons of coal used in its raw state in intermittent kilns of the old type. Further, assuming that 83 therms of gas are obtained from a ton of coal carbonised at a gasworks, nearly double this amount of heat energy is contained in the residuals—coke, tar and benzole— which would be lost by the direct use of solid fuel.

The consumption of electricity for heating ceramic kilns rose from 5 mill. units in 1953 to 14 mill. units in 1941. During the war years the consumption fell to 10 mill. units in 1945 but since then there has been a sharp rise to 60 mill. units in 1952. It has been stated that the generation of 60 mill. units required the burning of 32,000 tons of coal, and that the same output of ware in solid fuel fired kilns would require about 85,000 tons of coal.

In the coal-fired intermittent pottery oven the proportion of the heat input actually used in heating the ware is frequently below 5%. This figure may be increased several fold in gas-fired tunnel kilns and may be more than ten times as high in electrically heated ovens.

Allegations that excessive smoke, dust and grit were discharged from a gasworks were discussed with the group general manager of the gas board concerned and inspection of the plant carried out. The situation of the works, together with the age and condition of the plant, make it difficult to avoid the possibility of causing some local nuisance. In view of a scheme for replacing the works by a new one in a better position, expenditure on repairs and maintenance had been kept to a minimum but since nationalisation, an effort has been made to restore the plant to reasonably good condition. The retorts and gas collecting system have been overhauled and reconstruction of the coke handling and screening plants is in hand. To obviate wind borne dust, the stock of coke on the works site has been reduced. The complaint coincided with a period when the retorts were being operated under inadequate draught owing to a breakdown of the main gas exhauster and, consequently, the emission of smoke and fumes was more than usual. A new exhauster was installed and normal conditions in this respect were restored in the course of a few weeks. In short, it seems that the gas board is taking all proper and reasonable precautions but some cause for complaint is liable to occur from time to time until the new works is built.

Complaint against another gasworks indicated that the operations carried out in connection with a range of old purifiers were responsible for some atmospheric pollution. These purifiers are situated within a few yards of dwelling houses and although they are now operated well below their rated capacity, the manager agreed to take special precautions when they were opened for renewal or revivification of the oxide contained in them.

A number of new plants came into operation at gas liquor works during the year. The concentrated ammoniacal liquor produced is in the main sent to central works for conversion to pure liquor ammonia or to sulphate and other salts of ammonia; some is also used in the ammonia soda process. The data in Table I has been mainly supplied by the Ministry of Materials; figures relating to concentrated liquor having been collected by the Chief Inspector.

It has been necessary on a number of occasions to call attention to lesser causes for dissatisfaction such as inadequate feed to scrubbers, leaks on foul gas lines, cracks in oxide beds, bad condition of change valves, etc. On the whole maintenance of many of these plants (there are of course notable exceptions), has not come up to the standard desirable. Plants of this type are particularly susceptible to corrosion and good stocks of condenser tubes etc., for replacement should be carried. At gasworks and coke ovens a convenient

TABLE II.—TAR DISTILLED AND PITCH PRODUCED

Tons

	England and Wales 1952	England and Wales 1951	Scotland 1952	Scotland 1951
Tar distilled originating at:—				
Gasworks	1,488,400	1,509,400	198,950	204,730
Gas ovens	896,700	868,600	51,070	43,510
Other works	72,300	70,900	2,520	2,330
TOTAL TAR DISTILLED	2,457,400	2,448,900	252,540	250,570
Distilled or dehydrated to refined tar	553,000	575,100	84,010	92,410
Distilled to pitch	1,904,400	1,873,800	168,530	158,160
Gross pitch production	1,011,000	984,000	80,640	76,350
Pitch oiled back	418,800	404,700	26,440	16,780

TABLE I.—AMMONIA

Tons. Produced at Registered Works and Government Factories

From	Salts of Ammonia expressed as 25% NH_3		Concentrated Ammonia calculated as 25% strength	
	England and Wales	Scotland	England and Wales	Scotland
Gasworks liquor	106,800	7,560	66,000	3,590
Coke oven liquor	197,500	14,260	26,300	250
Shale works liquor	—	16,460	—	—
Synthetic processes	1,025,000	11,320	1,513,400	184,610
TOTAL	1,329,300	49,600	1,605,700	188,550

Note.—Much of the concentrated liquor was subsequently converted to salts. The total of salts plus concentrate is therefore greater than the net production of ammonia.

TABLE III.—SULPHURIC ACID

Tons. Calculated to 100% strength

Excluding Government plants except those producing for trade purposes

	England and Wales 1952	England and Wales 1951	Scotland 1952	Scotland 1951
Production	1,352,000	1,423,000	131,000	156,000
Proportion of plant in use (%)	77.5	81.2	51.7	61.6
Proportion Made (%):—				
In chamber plant	34.2	34.4	71.2	69.7
In contact plant	65.8	65.6	28.8	30.3
Raw Materials Used (*tons*):—				
Pyrites	149,000	127,000	59,000	70,000
Sulphur and H_2S	211,000	252,000	15,000	18,000
Spent Oxide	219,000	216,000	11,000	12,000
Zinc Ores	165,000	159,000	—	—
Anhydrite	176,000	178,000	—	—

method of foul gas disposal is to return it to the suction side of the works gas main via a suitable seal.

Registered tar works comprise 108 installations for the distillation of tar and 73 installations for secondary distillations involving the evolution of noxious or offensive gas. The 108 installations for the distillation of tar comprise 74 intermittent batteries and 44 continuous stills. At some works both types are in use. The figures shown in Table II are based on statistics supplied by the By-Products Branch of the Ministry of Fuel and Power.

There has been a further fall in the number of works registered, 148 compared with 155 in 1951, 175 in 1949, 269 in 1939 and 326 in 1931. The reduction is again due to the continued tendency to concentrate distillation in large central installations, the tar distilled being half as much again as it was 20 years ago. Replacement of batteries of intermittent pot stills by continuous units continues with consequent improvement in local conditions. Cessation of complaint is due in some instances almost entirely to this cause.

Table III relating to sulphuric acid is based on statistics supplied by the National Sulphuric Acid Association.

Trade conditions in the chemical industry were unsatisfactory, especially in the first half of the year but some signs of recovery were apparent towards the end of the year. Sulphuric acid production was restricted in those areas where it is dependent on viscose rayon and paper manufacture: it was not affected so much where it is chiefly absorbed for the manufacture of sulphate of ammonia or explosives or for oil refining purposes. Coke ovens, gasworks, iron and steel works and cement works were in full production.

The duty of securing smoke abatement lies primarily on local authorities. In practice, local authorities, the Ministry of Housing and Local Government, and Ministry of Fuel and Power work in close co-operation, and recourse to legal proceedings is comparatively rare. The Alkali Inspectors attempt to deal with cases of excessive smoke produced by industrial undertakings such as gasworks coke ovens, limekilns, and so on. The Fuel Efficiency Branch of the Ministry of Fuel and Power offers expert and practical advice in cases where faulty furnaces or the inefficient use of fuel is the cause of smoke production.

No B.I.F. Chemical Stand

THE ASSOCIATION of British Chemical Manufacturers has announced that it will not organise a chemical section at next year's British Industries Fair because of declining interest by both exhibitors and buyers. This, it was added, did not mean that the chemical industry had decided to leave the fair permanently.

The Association refers to the rapid decrease in the size of the section and considers that an exhibition is one of the important means of securing essential publicity for the chemical industry, and in principle supports the British Industries Fair as a suitable vehicle for this purpose. It is clear that the present arrangements are unsatisfactory and that a new approach is needed.

A.P.L.E. Exhibition

ADVICE on all aspects of gas street lighting, given by a team of experts, will be available on the Gas Council stand at the exhibition in conjunction with the annual conference of the Association of Public Lighting Engineers at Liverpool on September 15-17. Information will be available also on the various ways in which existing installations of street lighting by gas can be brought up to date, and about new installations which conform to the latest standards.

Practical advice will be given on such problems as the spacing and height of lamps and on their maintenance. It will be shown how the installation of new lanterns may often be more economical and more efficient than the maintenance of existing fittings. Technical data and literature will be available and photographs of the latest installations will be displayed. Street lighting engineers will find much of interest and of value in a visit to the lounge and information bureau which are incorporated in the stand.

North Thames Gas Board horses have registered several successes at local horse shows this month. They include: Willesden Carnival Show, 'Blue Boy,' first prize; Brentford and Chiswick Show (two entries), 'Inkspot' and 'Captain,' both first prize; Ealing Horse Show (three entries), 'Rosaman,' first prize and special class award, 'Colonel,' first prize, 'Monarch,' first prize. The Board's horses are under the charge of Mr. Charles Phipps, Foreman Horsekeeper, who has been at the Board's Brentford stables for more than 30 years.

Launch of the Thomas Livesey

THE m.v. *Thomas Livesey*, the 26th collier in the North Thames Gas Board's fleet, was launched recently at Sunderland from the shipbuilding yard of S. P. Austin & Sons, Ltd. The naming ceremony was performed by Mrs. L. C. Hansen, wife of Mr. L. C. Hansen, M.B.E., a member of the North Thames Gas Board. The *Thomas Livesey* is 257 ft. long, 39 ft. 6 in. broad and 18 ft. 6 in. deep, and is designed to carry a cargo of about 2,600 tons at a service speed of 10½ knots to the Board's up-river gas-making stations.

The propelling machinery which is being supplied by George Clark (1938), Ltd., of Sunderland, consists of an eight-cylinder Clark Sulzer marine diesel engine with one lever-driven scavenging air pump for each power cylinder. Auxiliaries will be driven by 220 volt electric motors. This new single screw motor vessel is of the raised quarter deck type with three clear holds and hatchways fitted with MacGregor single-pull steel covers. The latest navigational aids will be incorporated in the vessel's equipment.

The naming ceremony was performed by Mrs. L. C. Hansen (holding bouquet). Those in the group (left to right) are T. Millar, H. Hunter, H. Hewitt, Geoffrey Jones, Mrs. L. C. Hansen, Mrs. G. H. Blackford, R. Atkinson, Mrs. J. Young, Mrs. H. Hunter, E. Workman, Mrs. E. Workman, Mrs. J. C. Flisher, N. W. Rowstron, J. Young, J. C. Flisher, L. C. Hansen, T. Spry, G. H. Blackford, Mrs. T. Millar, Mrs. Hewitt, Miss Grieveson, Mrs. N. Rowstron.

Gas Sales and Service Conference

To go to Southport in 1954

THE Sales and Service Conference organised by the Gas Council will break new ground in 1954. An invitation from the North Western Gas Board for the third annual conference to be held in the North West has been accepted and the conference will take place in the Floral Hall, Southport, on Wednesday and Thursday, May 19 and 20.

The 1952 and 1953 conferences were held at the Seymour Hall, London, but it was considered that fresh interest would be stimulated if next year's proceedings took place in another area. Representatives from all gas boards attended the London conferences, but the largest number of salesmen, quite understandably, came from the North Thames, South Eastern, Eastern, and Southern Boards. It is hoped that larger numbers from other boards will be able to attend the 1954 sessions as a result of the decision to hold them at Southport. The resultant incentive and encouragement to salesmen will, it is hoped, be of great benefit to the whole gas industry, particularly if, as is intended, subsequent conferences are held in other areas.

The Floral Hall will comfortably accommodate numbers up to 800 for the main business sessions. These will be three in number, instead of four as at the first two conferences, the afternoon of the second day having been left free for official visits and other gatherings. Otherwise, the arrangements will be on similar lines to those which proved so successful at the Seymour Hall conferences. There will be a civic reception for the delegates by the Mayor and Mayoress of Southport at the Floral Hall on the first day. An exhibition of the latest gas and coke appliances will again be staged.

The first business session is provisionally titled 'Gas Appliances—Development, Production and Salesmanship.' It will include addresses by a panel of speakers representing the S.B.G.I. for the manufacturers; Watson House for the technical viewpoint; a gas salesman; and an authoritative lady journalist to speak on behalf of the housewife.

The second session, 'Organising a Sales Campaign,' with a speaker from outside the gas industry, will include contributions by Miss Mary Strong, Sales Manager, Cumberland Group, Northern Gas Board, and a representative of the S.B.G.I.

The third session, on the Thursday morning, is entitled 'Salesman's Viewpoint' and will be an open forum, headed by the main speaker, Mr. S. A. King, Commercial Manager of the Eastern Gas Board, with six selected gas sales representatives.

Hotel accommodation for delegates has been reserved, but any further enquiries concerning the conference, of which further details will be published in due course, should be addressed to Mr. R. J. Gregg, Publicity Manager of the Gas Council.

W.G.F. Visits De La Rue Works

MEMBERS of the Worksop branch of the Women's Gas Federation recently visited the works of Thomas De La Rue & Co., Ltd. (Gas Division), at Warwick. Accompanied by Mr. R. Wright, Sales and Service Manager of the East Midlands Gas Board's undertaking at Worksop, the members visited Warwick Castle before being welcomed at lunch at the Woolpack Hotel by Mr. A. T. W. Blair, Sales Promotion Manager, who introduced the guests to the members of the company who were to be their guides for the afternoon.

The visitors were conducted round the works in small groups and were shown all the stages in the manufacture of De La Rue cookers, infra red panels, 'Potterton' boilers, and 'Perfecta' gas controls, from the making of castings to final inspection and test, particular interest being shown in the production lines of the new G.4 cooker. At tea in the works canteen after the tour, Mrs. B. Sullivan, the Branch Chairman, and Mr. Wright expressed thanks for the hospitality extended to the visitors.

Consett (Co. Durham) Urban Council has been asked by the Northern Gas Board to increase the provision of gas appliances in new houses in view of the fact that the Board has spent £40,000 on capital works in the area. At present half the houses are fitted with solid fuel appliances, 25% with electricity and the rest with gas. It has been found that as most of the tenants are miners receiving free coal, the solid fuel houses are in greatest demand.

Colonial Students in Britain

THE British Council has this year almost doubled the number of places available to newly-arrived Colonial students on introduction courses designed to help them adapt themselves to life in the United Kingdom and to settle down to their studies. Between now and the end of September there will be 14 residential courses, with places for 280 students, at King's College Hall, Camberwell. Each course will consist of talks and discussions on such subjects as accommodation, the use of gas and electric appliances, care of health, how to get about London, and police services. There will be group visits to a library, a post office and other places of interest.

Students unable to secure places on these courses may attend two-day non-residential courses. Each student pays a fee for a residential course and applications have been received from students from Barbados, Basutoland, British Somaliland, Fiji, Gold Coast, Hong Kong, Kenya, Malaya, Malta, Nigeria, Northern Rhodesia, Nyasaland, Sarawak, Sierra Leone, Singapore, Trinidad and Uganda.

Applications for Lecturers on the use of copper in gas and other services can now be made to the Copper Development Association, Kendals Hall, Radlett, Herts. The Association's Building Engineer, Dr. E. Carr, and his assistants, are available for this free service, and the lectures can be illustrated with sound films or lantern slides where projection facilities are available.

GAS COUNCIL CHAIRMAN IN EAST MIDLANDS

COLONEL SIR HAROLD SMITH, Chairman of the Gas Council, recently paid a week's visit to the area of the East Midlands Gas Board. He was accompanied by the Deputy Chairman, Mr. Henry F. H. Jones, M.B.E.

Commencing his tour, Sir Harold called at the Basford works, Nottingham, the Nottingham offices, and the Derby Litchurch works. Another day was spent visiting the area display centre at Syston, the Commercial Manager's department and Beverley House at Leicester, Melton Mowbray works and the Oakham showrooms. He also visited Uppingham works, the Board's smallest undertaking.

On the day before returning to London, Sir Harold saw the Northampton works and offices and the Daventry works.

In this photograph, taken outside the stores at the small gasworks at Uppingham, the Board's smallest undertaking, are (left to right) Mr. R. Hutchinson (Leicester and Northants. Divisional Engineer), Mr. Henry F. H. Jones, Deputy Chairman of the Gas Council, Mr. S. J. Perry, Mr. Sydney Smith, Chairman of the Board, Colonel Sir Harold Smith, Mr. H. G. Adlington, Uppingham Local Manager, Mr. H. B. Taylor, Leicester and Northants. Divisional General Manager, and Mr. E. H. Harman, Deputy Chairman of the Board.

COMPANY NEWS

GEO. W. KING

Major A. C. Herring, addressing the 16th annual meeting of Geo. W. King, Ltd., in London, on August 11, said it was imperative, if industry in this country was to thrive and expand, that the level of taxation of company profits should be reduced. The company are specialists in the manufacture of materials handling equipment, and Major Herring told the shareholders that during the year under review business had been well maintained but, as foreshadowed last year, conditions were becoming more competitive and in this connection the concentration of work in one up-to-date factory at Stevenage should lead to their being able to manufacture under the most economic conditions. Export sales were now assuming considerable proportions. This, of course, was important, not only from the point of view of the company, but also from the national aspect. Sales for the first six months of the current year were rather less than for the corresponding period of 1952, but they had an excellent order book and subject to any general change in the trading situation he was hopeful that the results for the current year would not be unsatisfactory.

INCANDESCENT HEAT

Presiding at the 45th annual meeting of the Incandescent Heat Co., Ltd., at Smethwick on August 7, Mr. J. Fallon said the past year in many important respects proved to be an extremely interesting period in the affairs and progress of the company. Important contracts were completed in Canada and a thorough investigation was made into the potentialities of the Canadian market. In South Africa, one of their leading engineers made an exploratory visit and secured substantial business. In Italy, France and many other overseas countries, substantial progress was made both in regard to current and new contracts. Perhaps the most outstanding achievements had been in the field of new developments designed to meet the changing and more exacting demands of industry. During the year the parent company evolved and placed into production a new system of a jet recirculating radiant tube which found ready acceptance by leading companies here and in the United States. Considerable progress had been made in other important fields, such as gasification, high efficiency heat transfer and high intensity heating by tandem furnace lines. The rate of order bookings so far this year (1953) exceeded that of 1952 for the corresponding period by a substantial margin.

RUSTON & HORNSBY

The consolidated balance sheet of Ruston & Hornsby, Ltd., shows stocks and work in progress at £6,692,360, compared with £5,831,379 for the previous year, and debtors and advance payments at £3,009,019 against £2,762,286. Trading profits of the group were £301,697 higher at £2,328,939, and the net profit after payment of all charges, including tax, were up by £228,221 at £1,126,522. Dividend is being maintained at 11%, supplemented this year by a Coronation bonus of 1½%. Expressing the hope that the tax reduction in the last Budget heralds a downward trend to assist financing stocks, etc., Mr. W. J. Ruston, Chairman, in his statement issued with the accounts, says such financing in the year ended March 31, 1953, exceeded the group net profit by some £350,000. Financing additional stocks of £861,000, extra credit to customers of £247,000 and capital expenditure in excess of depreciation of £370,000, made the annual total £1,478,000. Present-day taxation, adds Mr. Ruston, accentuates the difficulties of financing trading requirements, maintenance of plant and equipment and limits credit that can be given in competition with other countries in overseas markets. A large part of capital expenditure is for replacements 'and there is much more still to be done.' Outstanding capital commitments of the group, mainly in respect of new tools and plant, total £840,226. A 50% interest is held in Ruston-Bucyrus, which concern, states Mr. Ruston, maintains its leadership in the excavator industry. Output and earnings expanded further with a net distribution of £101,000 paid to Ruston & Hornsby. Shareholders are informed that the equity of their company in the capital and reserves exceeds the par value of the investment by no less than £1,188,160.

UNITED GAS INDUSTRIES

The consolidated profit and loss account and appropriation account of United Gas Industries, Ltd., show that the profit for the year available for appropriation is £177,251 which together with £71,239 brought forward from last year provides an available balance of £248,490. A final dividend of 12%, making 17% for the year, leaves a balance to carry forward to next year of £83,704. In his statement circulated with the accounts, Lieut.-Col. W. C. Smith, Chairman, refers with regret to the death during the year of two directors. Mr. Arthur Charles had been a director since 1941 and was largely responsible for the layout of our factory at Streatham. Mr. H. E. Bennet joined the board only last year on the amalgamation of Alder & Mackay, Ltd., with United Gas Industries, Ltd. To fill the vacancy the directors have appointed Mr. Harold Bennet's brother, Mr. Stanley Bennet, who has become Chairman of Alder & Mackay, Ltd. Last year the Chairman warned shareholders of the possibility of a recession in trade. This recession came about in the latter part of 1952 and was continuing at the end of the financial year, with the result that turnover has shown a material decrease. In addition to falling turnover, the board had to contend with a continuing upward trend in costs. The actual trading profit for the year to March 31 amounted to £495,143 compared with £657,976 for the previous year, a decrease of approximately one-fifth which, having regard to the prevailing circumstances, is considered not entirely unsatisfactory. After providing for depreciation of fixed assets, etc., the net profit for the year before tax amounts to £426,743 as against £570,644 for the previous year. Excess profits levy, profits tax and income tax absorb £256,999 as compared with £360,495 for the previous year, with the result that the final net profit after crediting certain taxation provisions no longer required, amounts to £182,695 compared with £215,405 for the previous year. Sales of gas meters and gas appliances amount to 48% of total turnover, the other 52% being devoted to activities outside the gas industry.

News in Brief

The Address of the Head Office of the following companies is now 117, Lichfield Street, Walsall, Staffs.: Normanby Park Tar Supply Co., Ltd., Lincolnshire Chemical Co., Ltd., Lane Brothers (Tar Distillers), Ltd., Lane Brothers (Tar Investments), Ltd., Lane Brothers (Tank Wagons), Ltd.

New Large Scale Tests on underground gasification of coal are to be carried out at a Ministry of Fuel and Power experimental station near Bewdley, Worcestershire. The experiments were started last year, and the gas which is produced by the reaction when air is forced into an ignited seam drives an engine which in turn generates electricity. This is the only experimental station in the world producing electricity in this way.

Llandarcy Refinery Expansion.—The current expansion scheme at the Anglo-Iranian Oil Company's Llandarcy refinery is nearing completion. Two new units have recently been commissioned, while another two will begin operation at the end of the summer, the refinery's annual capacity being raised to over 4 mill. tons a year. The two latest plants commissioned are a furfural and a gas oil heating unit, which play an important part in the manufacture of lubricating oils, as do also the other plants shortly to be commissioned, including a propane deasphalting plant and an M.E.K. dewaxing unit.

Smethwick is to pay 5% more for its street gas lighting. Under the present system, gas is supplied partly from the Smethwick works and partly from Birmingham, and is charged for separately. An agreement has now been reached, however, with the West Midlands Gas Board that the price paid by the Council will be based on the aggregate consumption of the gas.

Mr. J. Humphries, a member of the Interplanetary Society of Great Britain, is to lecture on the subject of 'Interplanetary Flight' at Leeds University on October 26. The lecture has been arranged by the Incorporated Plant Engineers, who have invited the members of the Manchester and District Section of the Institution of Gas Engineers to attend. Invitations have also been sent to other engineering and scientific bodies in the locality.

The National Coal Board has announced the two main functions of its proposed Central Engineering Establishment. The first is the development of new machinery and equipment, wherein the establishment is intended to supplement the work of those manufacturers who serve the coal industry. The establishment will also be concerned with the testing of machinery, ropes, new materials, etc., and with the improvement of testing methods. A site in Derbyshire is being considered.

PUBLISHERS' NOTICE

The " Gas Journal " is published every Wednesday, price 1/3d.; by post 1/5d.

Subscription Rates: Home and Empire:—52/- per annum; Foreign:—60/- per annum. (Both payable in advance.) A copy of the " Gas Journal " Calendar & Directory is presented each year to continuous subscribers.

Classified Advertisements: All small classified advertisements are charged at 1/9 per line (approx. 7 words)—minimum charge 10/6. A Box Number address occupies 2 lines, and a further 6d. is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's Journal.

Displayed Advertisements: Rates obtainable on application to the Business Manager. Change of copy for displayed spaces must be received 14 days prior to publication if proofs are required. Type area of inside pages 10" deep × 7" wide; block screen 120.

BUSINESS MANAGER: S. T. CULLEN

MIDLANDS OFFICE: 10, Union Street, Birmingham.

NORTHERN MANAGER: W. Q. Foster, 33, St. Helens Road, Harrogate. *'Phone:* Harrogate 84291.

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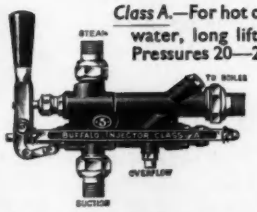

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APPOINTMENTS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18–64 inclusive or a woman aged 18–59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

EAST MIDLANDS GAS BOARD

LEICESTER & NORTHANTS DIVISION

SHOWROOM SUPERINTENDENT—NORTHAMPTON UNDERTAKING

APPLICATIONS are invited from suitably qualified persons for the position of SHOWROOM SUPERINTENDENT at the Northampton Undertaking.

Applicants must have had considerable experience of Showroom supervision, appliance sales and consumer service, and be well versed in window and general display practice.

The appointment will be made in Grade A.P.T. VIII (£585-£665 per annum) and the commencing salary will be in accordance with the experience and qualifications of the person appointed.

The successful candidate may be required to pass a medical examination, and unless already subject to a pension scheme by virtue of the Gas (Pension Rights) Regulations, 1950, will be required, if eligible, to join the Board's Staff Pension Scheme within six months from taking up the appointment.

Applications stating age, experience and qualifications and giving the names of two referees should be addressed to the undersigned to be received not later than Thursday, August 20, 1953.

H. B. TAYLOR,
Divisional General Manager.

Gas Offices,
Millstone Lane,
Leicester.
July 31, 1953.

WEST MIDLANDS GAS BOARD

WARWICKSHIRE DIVISION
DEPUTY ENGINEER AND MANAGER—HINCKLEY DISTRICT

CANDIDATES must have a sound technical training and practical experience of modern Gas Production and Distribution including the construction, operation and maintenance of all plant and equipment at a medium-size Gas Works. Possession of the Higher Grade Certificate of the Institution of Gas Engineers, or its equivalent, is a minimum qualification.

The salary for the post will be within Grade XII (£740-£865 per annum) of the National Salary Scales for Gas Staffs.

A house or flat may be available at a reasonable rent.

The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications, stating age, qualifications and experience, together with the names of two referees, should be addressed to Mr. A. Allen, Divisional General Manager, West Midlands Gas Board, Warwickshire Division, Gas Street, Coventry, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

WARWICKSHIRE DIVISION
CHIEF TECHNICAL ASSISTANT—RUGBY DISTRICT

CANDIDATES should possess practical experi- ence of the operation of Vertical Retort Installations, C.W.G. plant and normal gas works ancillaries; be experienced in carrying out all usual gas works tests, and hold the Higher Grade Certificate in Gas Manufacture of the Institution of Gas Engineers.

The salary for the post will be within Grade IX (£615-£715 per annum) of the National Salary Scales for Gas Staffs.

It is expected that a house, at a reasonable rental, will be available in the near future, if required.

The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications, stating age, qualifications and experience, and giving the names of two referees, should be addressed to Mr. A. Allen, Divisional General Manager, West Midlands Gas Board, Warwickshire Division, Gas St., Coventry, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON,
Secretary to the Board.

EASTERN GAS BOARD

NORWICH DIVISION
GREAT YARMOUTH GROUP
HOME SERVICE ADVISER

APPLICATIONS are invited for the above position. Candidates should preferably be qualified in Domestic Science and be experienced in the use of Domestic Cooking and other appliances and in the organisation of Cookery Demonstrations, Lectures and District Home Service Calls.

The appointment will be within the Grade A.P.T. VI (Female) (Provincial 'A') (£392-£456 per annum) of the Scales agreed by the National Joint Council for Gas Staffs and will be subject to a satisfactory medical examination and entry into the Board's Superannuation Scheme.

Applications, stating age, qualifications and experience, should be addressed to the undersigned and be received within twenty-one days of the appearance of this advertisement.

J. H. GREENACRE,
Manager.

Great Yarmouth Group,
Eastern Gas Board,
40, King Street,
Great Yarmouth.

(*Classified advertisements continued on page* 486)

APPOINTMENTS VACANT (ctd.)

WALES GAS BOARD

TECHNICAL ASSISTANT—
MONMOUTH GAS & WATER UNDERTAKING

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT to the above Undertaking.

Applicants should be qualified for the duties of the post and have coal carbonisation (verticals) and distribution experience.

The salary will be within A.P.T. Vb (£445/525 per annum). A flat on rental terms is available. The post is superannuable and the successful candidate may be required to pass a medical examination.

Applications, stating age, training and qualifications, accompanied by the names of two referees, should reach the undersigned not later than August 31, 1953.

C. E. PRITCHARD,
Manager.

Mayhill,
Monmouth.

WALES GAS BOARD

ASSISTANT INDUSTRIAL GAS ENGINEER—
NORTH WALES

APPLICATIONS are invited for the above appointment within the salary range of A.P.T. Grade Xa (£665/765 per annum). Applicants should have had considerable experience in the installation and operation of large scale catering appliances, hot water and central heating installations and other commercial and small industrial gas appliances, and should possess the Higher Grade Certificate of the Institute of Gas Engineers (Supply) or equivalent qualification. The successful applicant will be required to pass a medical examination and to subscribe to such scheme of superannuation that the Board may adopt.

DISTRIBUTION SUPERINTENDENT—
EBBW VALE & BEAUFORT UNDERTAKING

Applications are invited for the position of Distribution Superintendent of the above Undertaking within the Staff Salary Scale A.P.T. VIb (£475/£555 per annum) inclusive. A house is available at Beaufort.

The post will be a progressive one and the applicant must be able to supervise major extensions to the gas distribution system and to take charge of the fittings and maintenance staff in an area where considerable scope for expansion exists.

Applicants should possess the following qualifications or their equivalents:

(*a*) London City and Guilds Final Certificate in Gas Fitting.

(*b*) London City and Guilds Certificate in Gas Technology of Supply.

The successful applicant will be required to pass a medical examination and join the Board's Superannuation Scheme.

Applications, giving details of age, qualifications and experience, together with the names of two referees, should reach the undersigned not later than August 31, 1953.

C. B. MAWER,
Secretary to the Board.

2, Windsor Place,
Cardiff.

APPLICATIONS are invited from young men aged approximately 24/30 for appointment as PLANT OPERATING ENGINEER in the Chemical Engineering Department of Newton Chambers & Co., Ltd., Thorncliffe, near Sheffield. The appointment will involve plant supervision in various parts of the country, including starting up and performance testing. Previous experience in the operation of Tar Distillation Plant will be an important advantage. Apply in writing to the Personnel Officer, stating age, qualifications, salary required and when at liberty.

NORTH WESTERN GAS BOARD

NORTH CHESHIRE AND PEAK GROUPS
GROUP INDUSTRIAL GAS ENGINEER

APPLICATIONS are invited from trained and qualified Engineers for the above pensionable appointment at a commencing salary of £1,000 per annum.

Applicants should have full knowledge of the utilisation of gas and other fuels in Industrial and Commercial establishments, together with wide experience of the design, development and operation of Industrial and Commercial gas burning equipment.

Detailed applications, giving the names of two referees, should reach the Secretary, North Western Gas Board, 60 Whitworth Street, Manchester, 1, within fourteen days.

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FOR SALE :—**19 Vols. Trans. Inst. Gas E. 1927-43 and 46-48, £76.** All in perfect condition. Apply: No. 160, *Gas Journal*, 11, Bolt Court, Fleet St., London, E.C.4.

FOR SALE

THE EASTERN GAS BOARD have for disposal a Drakes Combined Horizontal CHARGING and DISCHARGING MACHINE suitable for four-tier retorts and fitted with 230 volt D/C motors, in good working order. There is also available for use with the above a 35 kW Mercury Arc Rectifier, A/C-D/C, made by the Electric Construction Company.

These machines are situated at the Chelmsford Works and may be seen there on application to the District Manager from whom any further particulars may be obtained.

W. J. COLLINS GARRARD,
General Manager.

Ipswich Division,
Eastern Gas Board,
Crane Hill Lodge,
London Road,
Ipswich.
August 11, 1953.

URBAN DISTRICT COUNCIL OF NEWRY

GAS DEPARTMENT

TENDERS are invited for the supply and delivery of four sets of PURIFIER GRIDS. Specification and Form of Tender may be obtained, on application, from the undersigned. Sealed tenders, endorsed "Purifier Grids," are to be submitted not later than Saturday, September 5, 1953.

The lowest or any Tender not necessarily accepted.

MICHAEL MAGUIRE,
Secretary.

APPOINTMENT WANTED

COKE OVEN MANAGER AND ENGINEER, with Gas Works Superintendent experience, covers construction of all new plant, re-erection of all old plant, retort settings and ironwork, and maintenance (both electrical and mechanical). Vast workshop experience of all manufacturing problems. Salary not of first importance. Age 47 years.—Box No. 157, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

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FISRT DEMPSTER TRAVELLING FELLOWSHIP

APPLICATIONS are invited, before Sept. 15, 1953, for the FIRST DEMPSTER TRAVELLING FELLOWSHIP of The Institution of Gas Engineers. The Fellow will be required to make, during a stay of 2-3 months on the Continent, a study of recent technical developments, in France, Holland and Belgium, in the distribution of gas for town purposes. Applicants must not be over 30 years of age and must be Corporate Members of The Institution of Gas Engineers, having practical experience of gas distribution. The value of the Fellowship (including subsistence and travelling expenses) will be up to £200. Conditions from the Secretary, The Institution of Gas Engineers, 17, Grosvenor Crescent, London, S.W.1.

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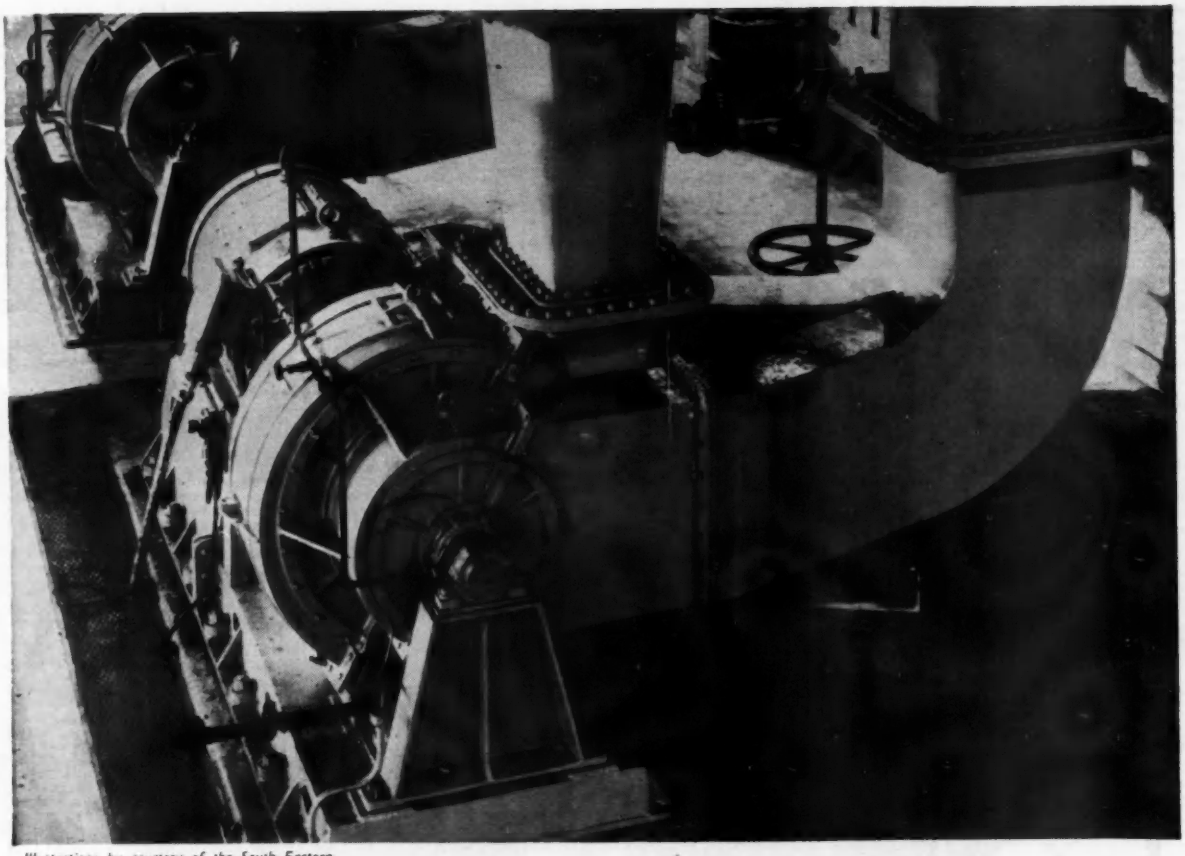

Illustrations by courtesy of the South Eastern Gas Board and Messrs. Humphreys & Glasgow Ltd.

Gas Boosting *

Part of an installation at the East Greenwich Gas Works for the supply of South London's gas are the "TORNADO" gas boosters illustrated above. Each is capable of shifting over a million cubic feet of producer gas an hour, and each was supplied with cast iron gas tight casings with detachable segments for easy servicing, stainless steel impeller and shaft, self aligning roller bearings and flexible couplings. One of the boosters was arranged for motor drive and the other for steam turbine.

*

LARGE ILLUSTRATION: *42" type 9 double width double inlet gas boosters.*

DUTY: 1,095,000 cu. ft. per hour producer gas at 104°F. saturated, giving 28" w.g. differential over inlet and outlet connections taking 138 H.P.

SMALL ILLUSTRATION: *40" type 15 air blowers.*

DUTY:	Closed outlet	Delivery
Air quantity	nil	12830 c.f.m.
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We are manufacturing gas boosters which cover a range of from 5,000 to 1,500,000 cubic feet per hour, and if you are concerned with the movement of air or gas, ask us to send you Publication No. 5/7, a survey of the standard range of "TORNADO" high pressure blowing and exhausting fans.

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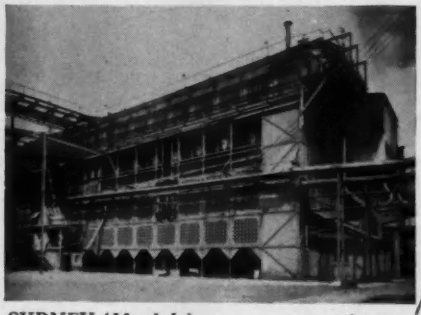
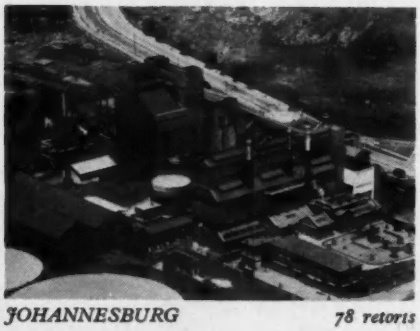


SYDNEY (Mortlake) *496 retorts*

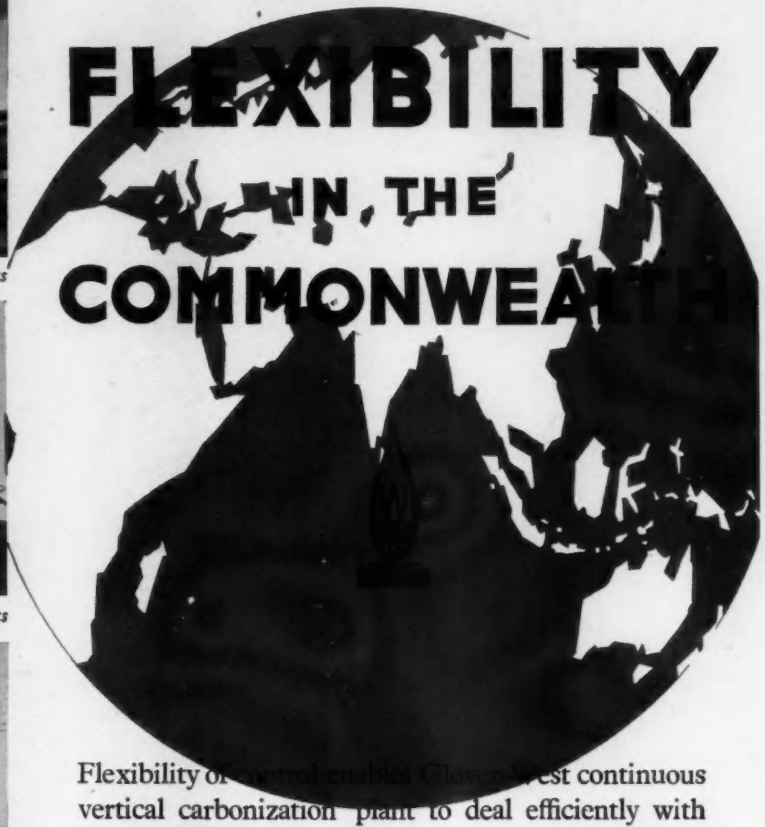
SOUTH BRISBANE *56 retorts*

WELLINGTON *96 retorts*



JOHANNESBURG *78 retorts*

TORONTO *104 retorts*



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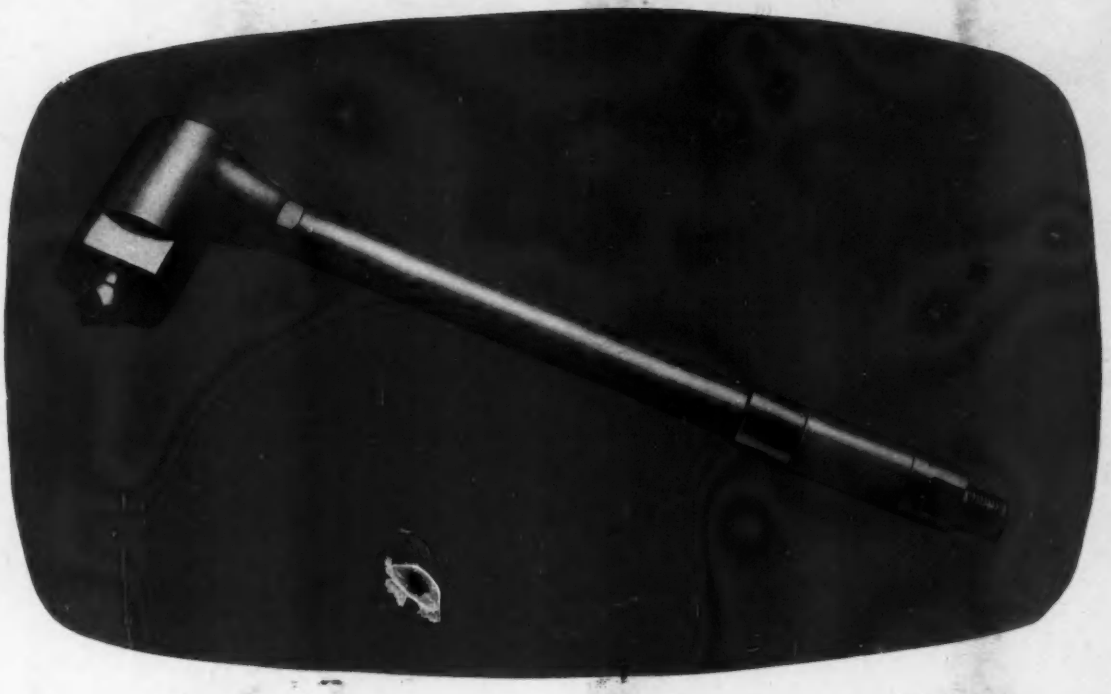

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